

REPORT
OF THE
DEPARTMENT OF THE NAVAL SERVICE
FOR THE
FISCAL YEAR ENDED MARCH 31, 1922

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1922

REPORT

DEPARTMENT OF THE NAVAL SERVICE

FOR FISCAL YEAR 1921-22

*To General His Excellency the Right Honourable Lord Byng of Vimy, G.C.B.,
G.C.M.G., M.V.O., Governor General and Commander-in-Chief of the
Dominion of Canada.*

MAY IT PLEASE YOUR EXCELLENCY:

I have the honour to submit herewith for the information of Your Excellency and the Parliament of Canada, the Twelfth Annual Report of the Department of the Naval Service, being for fiscal year 1921-22.

I have the honour to be,

Your Excellency's most obedient servant,

GEORGE P. GRAHAM,

Minister of the Naval Service.

OTTAWA, ONTARIO, June 30, 1922.

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REPORT
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OTTAWA, June 30, 1922.

Honourable GEORGE P. GRAHAM,
Minister of the Naval Service,
Ottawa, Ont.

SIR,—I have the honour to report on the Department of the Naval Service for the fiscal year 1921-22, under the following headings:—

- 1. Royal Canadian Navy.
- 2. Fisheries Protection Service
- 3. Survey of Tides and Currents.
- 4. Hydrographic Survey.
- 5. Radiotelegraph Service.
- 6. Stores.
- 7. Financial Statement.
- 8. Canadian Arctic Expedition.
- 9. General.

1. ROYAL CANADIAN NAVY

ROYAL NAVAL COLLEGE OF CANADA

The Royal Naval College of Canada was established at Halifax, N.S., in 1910, and Commander A. E. Nixon was placed in charge.

Examinations for cadetships have been held each year by the Civil Service Commission since the establishment of the college. The following is a statement of the number of cadets who entered the college each year:—

January, 1911..	21
" 1912..	10
" 1913..	8
August, 1913..	4
" 1914..	8
" 1915..	6
" 1916..	14
" 1917..	20
" 1918..	16
" 1919..	17
" 1920..	15
" 1921..	11

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Arrangements were under way to hold the usual cadetship examinations in June, 1922, but, owing to the decision of the Government to close down the Naval College, the holding of the examinations was cancelled. Twenty-six applications for entry to the cadetship examinations in June, 1922, were received by the Civil Service Commission.

Although graduated cadets, who entered the college after 1913, were not obliged to adopt a naval career, all those who successfully passed the Naval College course from its establishment up until the end of the 1918 term adopted the Navy as a profession. At the termination of the war, however, a number of them dropped the naval career and took up civil avocations.

Arrangements were made in 1914 with the Universities of McGill and Toronto, and later with Queen's University, whereby Naval College graduates were allowed to enter these universities, without examinations, in the second year of the course of Applied Science.

In the fall of 1919, one naval cadet; and in 1920, seven naval cadets entered McGill University under this arrangement. Three naval cadets entered Toronto University in 1921.

In April, 1922, when it was decided to discontinue the Naval College, the arrangements with the Universities of McGill, Toronto and Queen's were extended so that second year naval cadets were permitted to enter, without examination, the first year of the course of Applied Science. The University of British Columbia agreed to similar arrangements and also to permit first year cadets to enter the first year Arts Course.

The course provided at the Naval College was of a high standard and naval cadets have been successful both in naval and civil life.

In 1917, the Halifax explosion wrecked the Naval College buildings to such an extent that they were no longer habitable. The college year was completed at Kingston and in the fall of 1918, the college was established at Esquimalt, B.C., where it continued in operation up to its close in June, 1922.

Commander A. E. Nixon, who has been in charge of the Royal Naval College since its establishment, has been highly successful in organizing and maintaining the establishment in an efficient condition and the successes attained were largely attributable to his zeal and ability. The naval professors at the college also deserve credit for the painstaking manner in which they performed their duties.

The health of the cadets at the Naval College has, throughout, been exceptionally good. This is attributable to two main causes:—

Firstly—The very high standard of physical fitness required of cadets on entry to the college, and,

Secondly—To the regular hours and training.

The Naval College has, during the whole period of its operation, been a success and it has accomplished in a high degree the objects for which it was established.

ROYAL CANADIAN SHIPS

At the beginning of the fiscal year 1921-22 H.M.C.S. *Aurora*, *Patriot* and *Patrician* were at Esquimalt, having completed the long cruise from Halifax via Panama canal in March, 1921. After refit at Esquimalt the squadron proceeded to Comox, Vancouver Island, where forty men from the *Aurora* and ten from each of the two destroyers went ashore and carried out rifle target practice and disciplinary training. This training produced great improvement in the discipline and general bearing of the crews, especially the boys and ordinary seamen. During the same period (April 14 to May 10, 1921) the ships also carried out general drill, including gunnery and torpedo practices.

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The squadron left Esquimalt on June 3, 1921, for Halifax, where it arrived on July 30, 1921. Visits were paid en route to Astoria (Oregon), San Pedro (California), Magdalena Bay (Lower California), Acapulco (Mexico), Salina Cruz (Mexico), Punta Arenas (Costa Rica), Panama, Kingston (Jamaica), and Bermuda.

During this cruise, exercises were performed whenever the state of the weather permitted, including night-firing, tactics, and range taking exercises.

At Magdalena Bay an extensive programme of general drills, boat pulling, torpedo and gunnery exercises, was carried out. Permission to carry out these exercises was courteously granted by the Mexican local officials. The exercises were of value in improving the fighting efficiency of the squadron.

On arrival at Halifax, a series of combined exercises were arranged with the military garrison and local air force from the 22nd to the 26th August, 1921. These exercises included all the steps that would have to be taken for the defence of Halifax Harbour—

- (1) During a period of strained relations with a foreign power;
- (2) On the outbreak of hostilities, and,
- (3) For the control of shipping entering and leaving Halifax in war.

They were carefully worked out in detail beforehand and showed the possibilities for co-operation between the three forces in the defence of Halifax Harbour.

Submarines CH 14 and CH 15, which had been commissioned on March 3, 1921, took an active part in these exercises. The majority of the crews of these ships were obtained by local recruiting and were trained by a Lieutenant, R.C.N., who had served during the war in the Imperial Submarine Service.

After the completion of the joint exercises at Halifax the Canadian Squadron cruised to Montreal where they were inspected by the Governor General and the Minister of the Naval Service. The ships were opened to the public for several days and were visited by large crowds.

They also visited St. John, N.B., where they were inspected by the Lieutenant-Governor of the province and the mayor of St. John city. Various other ports of the Maritime Provinces were visited.

The two submarines left for Bermuda in November 1921, and the *Aurora* *Patriot* and *Patrician* joined them there in December, 1921.

During the passage of the squadron to Bermuda a severe hurricane was encountered. The sea was so violent that the ships were obliged to run before the gale. They came through the test in excellent condition and demonstrated most completely their seagoing qualities.

During their cruise in the West Indies, every available opportunity was taken to carry out gunnery, torpedo and tactical exercises. The presence of the Imperial Light Cruiser Squadron offered an excellent opportunity for combined exercises on a large scale. These exercises are of great value in the training of the squadron.

During the whole year, wherever the squadron visited, a warm welcome was extended to the officers and men. The ships were crowded with visitors on all occasions when the public were admitted to them and the general impression created was excellent.

The activities of the squadron during the past year may be summarized as a steady progress towards fighting efficiency. The high standard of discipline and conduct of the men and the efficiency of the squadron itself, has created an impression that reflects credit, not only on the officers and men of the Squadron, but also on the Dominion of Canada whose representative it is.

The health of the officers and men of the Canadian Squadron has been excellent throughout the year.

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The following is a statement of movements of the ships of the Canadian Squadron during the year:—

Ship	Place	Arrived	Sailed
		1921	1921
<i>Aurora</i>	Esquimalt.....		April 14.
Destroyers.....	".....		April 16.
<i>Aurora</i>	Comox.....	April 14.....	May 11.
Destroyers.....	".....	April 17.....	May 10.
Destroyers.....	Nanaimo.....	May 10.....	May 12.
Squadron.....	Esquimalt.....	May 12.....	
<i>Aurora</i>	".....	May 12.....	June 3.
<i>Patrician</i>	".....	May 12.....	June 3.
<i>Patriot</i>	".....	May 12.....	June 7.
<i>Aurora</i>	Astoria.....	June 4.....	June 11.
<i>Patrician</i>	".....	June 4.....	June 7.
<i>Patrician</i>	Portland, Ore.....	June 7.....	June 11.
<i>Patriot</i>	".....	June 8.....	June 11.
Squadron.....	San Pedro.....	June 14.....	June 16.
".....	Magdalena Bay.....	June 18.....	June 23.
".....	Acapulco.....	June 26.....	June 30.
".....	Salina Cruz.....	July 1.....	July 3.
".....	Punta Arenas.....	July 6.....	July 9.
".....	Colon.....	July 11.....	July 12.
".....	Jamaica.....	July 14.....	July 18.
".....	Bermuda.....	July 22.....	July 27.
".....	Halifax.....	July 30.....	
<i>Aurora</i>	".....		Aug. 10.
<i>Patrician</i>	".....		Aug. 10.
<i>Patriot</i>	".....		Aug. 15.
<i>Aurora</i>	Sydney, C.B.....	Aug. 11.....	Aug. 15.
<i>Patrician</i>	".....	Aug. 11.....	Aug. 15.
Squadron.....	Charlottetown.....	Aug. 16.....	Aug. 19.
".....	Halifax.....	Aug. 20.....	Aug. 27.
".....	Gaspé.....	Aug. 29.....	Aug. 30.
".....	Montreal.....	Sept. 1.....	Sept. 8.
".....	Quebec.....	Sept. 9.....	Sept. 14.
".....	Halifax.....	Sept. 17.....	Sept. 20.
Submarines.....	".....		Sept. 20.
Squadron and subs.....	St. John, N.B.....	Sept. 21.....	Sept. 25.
".....	Halifax.....	Sept. 26.....	
<i>Patriot</i>	".....	Sept. 25.....	Sept. 26.
<i>Patriot</i>	Baddeck.....	Sept. 27.....	Sept. 28.
<i>Patriot</i>	Halifax.....	Sept. 29.....	
Submarines.....	Halifax.....	Sept. 26.....	Nov. 23.
".....	Bermuda.....	Nov. 28.....	
Squadron.....	Halifax.....		Dec. 10.
".....	Bermuda.....	Dec. 14.....	Dec. 27.
".....	St. Kitts.....	Dec. 31.....	1922 Jan. 3.
".....	Roseau (Dominica).....	1922 Jan. 4.....	Jan. 6.
".....	Barbados.....	Jan. 7.....	Jan. 16.
".....	Grenada.....	Jan. 17.....	Jan. 19.
".....	Trinidad.....	Jan. 19.....	Feb. 21.
".....	Demerara.....	Feb. 22.....	Mar. 1.
".....	Trinidad.....	Mar. 4.....	
<i>Aurora</i>	Trinidad.....		Mar. 7.
".....	Tobago.....	Mar. 7.....	Mar. 9.
".....	Trinidad.....	Mar. 9.....	
<i>Aurora</i> and destroyers.....	Trinidad.....		Mar. 30.
".....	Bermuda.....	April 4.....	
<i>Aurora</i> , destroyers and subs.....	Bermuda.....		April 8.
".....	Halifax.....	April 11.....	

Owing to the decision of the Government to economize and the consequent reduction in Naval estimates of one million dollars (\$1,000,000), the department was obliged to place out of commission the cruiser *Aurora* and submarines. These ships were paid off on June 30, 1922. Officers and men loaned from the Royal Navy returned to England and Royal Canadian Naval officers and men required for the service were

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transferred to the destroyers *Patriot* and *Patrician* which are being continued in commission. It is proposed to place one destroyer on the Atlantic coast and one on the Pacific coast. A number of trawlers will be maintained on each coast for mine-sweeping, mine-laying and other port defence training.

The Government announced its intention to establish a volunteer force who would train for a period of three weeks each year, the training to extend over a three year course.

The necessary arrangements are under way to put into operation the policy of the Government.

During the season of 1922 the Government brought down legislation combining into one department, to be known as the "Department of National Defence", the Militia and Defence Department, the Canadian Air Force and the Naval Service Department. Preparatory to the organization of the new department the following branches of the Naval Department were transferred to Marine and Fisheries Department:—

Hydrographic Survey;
Fisheries Protection Service;
Tidal and Current Survey;
Radiotelegraph Service, and,
Patrol of Northern Waters.

This transfer became effective from June 30, 1922.

NAVAL INTELLIGENCE

In April, 1921, by arrangement with the British Admiralty the Canadian Naval Service Department took over all naval intelligence work for the North American continent. An Intelligence Office was established under the Naval Service Department at Ottawa which has now become one of the large intelligence centres in the Admiralty world-wide organization. The department appointed a Supervising Intelligence Officer, who took up his duties on April 23, 1921. Under his supervision new branches of Intelligence work were undertaken, especially with regard to British and other shipping using the trade routes in the Ottawa Intelligence area.

New sources of information were opened up, and the centre is now fulfilling its complete functions as an important link in the Admiralty Intelligence chain.

YOUTHS' TRAINING ESTABLISHMENT, HALIFAX, N.S.

In connection with the development of a purely Canadian Naval Service, a Training Establishment for youths was established at Halifax, N.S., in October, 1921. The officer in command, together with a staff of instructors, were loaned from the Admiralty and, by the end of November, there were 58 youths entered for training as seamen and stokers.

This establishment functioned fully and efficiently throughout the periods in which it was in operation. It was closed in June, 1922, following reductions in the Royal Canadian Navy and boys in attendance not required for service in H.M.C. ships were sent home.

H.M.C. DOCKYARDS—HALIFAX AND ESQUIMALT

Halifax Dockyard.—This establishment carried out its functions in a satisfactory manner throughout the year. The operation of the technical branches under the re-organized system, whereby all classes of trades and workmen were placed under the control of one head, has proved highly satisfactory.

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The dockyard carried out repairs and refits to all ships of the Canadian Squadron and also to ships of the Fisheries Protection Service, Hydrographic Survey, Department of Militia and Defence, Department of Marine and Fisheries, Department of Customs and other Canadian Government services. Ships of the Imperial Navy, French Navy, and also vessels belonging to private individuals, were repaired during the year. Various works, other than repairs to ships, have also been performed for the British Admiralty, American Government and departments of the Canadian Government and private individuals.

Esquimalt Dockyard.—The activities of this dockyard have been restricted during the year, only minor repairs having been carried out.

GENERAL

The Canadian Navy, including all ships and establishments, have performed their functions in a very satisfactory manner throughout the year.

2. FISHERIES PROTECTION SERVICE

The Fisheries Protection Service is maintained for the purpose of protecting Canadian fisheries in Canadian coastal waters and along the international boundary line in the Great Lakes.

Foreign vessels are not permitted to fish within the Canadian three-mile limit or in the Canadian waters of the Great Lakes. United States fishing vessels are, however, under the Treaty of 1818, allowed to call at Canadian ports for wood, water, shelter, or repairs. The patrol of the Fisheries Protection Service is necessary to maintain observance of all fisheries regulations by foreign fishing vessels passing through Canadian waters. A close co-operation is maintained between the Fisheries officials, Customs officers, and the Fisheries Protection officers, in order to ensure the strict observance of the Canadian regulations.

EAST COAST

On the east coast fisheries protection patrol was carried out by the *C.G.S. Arleux* and *C.G.S. Arras*.

C.G.S. Arleux.—*C.G.S. Arleux*, under command of Captain W. J. Milne, patrolled to the west of Halifax, to and including the Bay of Fundy. This ship carried out scouting operations in connection with the mackerel fisheries during May and June, 1921. The salmon and herring fishing fleets were also looked after and a careful watch for illegal fishing was kept up. A large number of vessels were boarded under authority of the Fisheries and Customs Acts, and in some cases fines for infractions of the regulations were imposed.

During the season sixty-eight lobster traps, illegally set, were destroyed.

In August the vessel proceeded to Halifax and took part in the combined exercises of the Military, Naval and Air Forces. During these exercises the vessel was employed on examination and mine-sweeping duties.

Assistance was rendered to twenty-two vessels during the year, mostly during the winter months when the ice was heavy. From January to March ice-breaking duties in the various harbours to the west of Halifax were performed and a number of ice-bound schooners were freed. During the International Fishermen's race off Halifax, the *Arleux* was placed at the disposal of the officials in charge of the race. She also performed calibration work for the Radiotelegraph Branch.

During the year the vessel was under way 1,441 hours and covered 13,505 miles.

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C.G.S. Arras.—This ship, commanded by Captain Clement Barkhouse, was stationed to the eastward of Halifax and patrolled the coast waters, including Northumberland strait and the Magdalen islands area. She was commissioned on April 1, 1921, and with the *Arleux* performed mackerel scouting duties during May and June, 1921.

The United States schooner *Hazel M. Jackson* was blacklisted for illegal fishing detected by this ship, which also seized forty-four lobster traps during the season.

The *Arras* worked in conjunction with the Canadian Squadron, Military Forces and Air Service, during the combined exercises in August. The ship also assisted the Radiotelegraph Branch in calibrating off Cape Race Direction Finding Station. In December, 1921, and January, 1922, the *Arras* was engaged off Canso, N.S., for the purpose of rendering assistance to disabled vessels of the fishing fleet. Weather conditions in this district are bad during the winter months and fishing operations are dangerous. The *Arras* was on hand to render assistance as required.

In March, 1922, she was engaged in ice-breaking duties in the small harbours east of Halifax.

During the year the ship was under way 1,402 hours and steamed 12,170 miles.

GREAT LAKES

C.G.S. Becancour, in command of Captain P. C. Robinson, went into commission on April 7, 1921. The headquarters of this vessel is at Port Dover and its commanding officer is in charge of Fisheries Protection operations on lake Erie.

During the season, which lasts from the time the ice breaks up in the spring until the close of navigation in the autumn, the ship seized 195 nets, which were destroyed or sold.

During the year the vessel steamed 906 hours and covered 7,067 miles.

C.G.S. Lavolette.—This vessel was also employed during the year on lake Erie. Captain C. O. Macdonald was in command, with headquarters at Kingsville.

During the season the vessel seized 123 nets, which were sold. During the month of November the ship was engaged in gathering eggs for the fish hatchery at Kingsville.

During the season she was under way 760 hours and covered 5,875 miles.

WEST COAST

C.G.S. Malaspina.—This vessel was in commission on the west coast in charge of Captain Holmes Newcomb.

During the season the *Malaspina* was responsible for the seizure of three American fishing boats and one schooner, the last named for smuggling. The fishing boats were confiscated and the owner of the schooner was fined \$1,400 and released.

In addition to fisheries duties, the vessel assisted the Radiotelegraph Service in transferring equipment, etc., from the abandoned station at Triangle island to the new station at Bull Harbour, and by helping with calibration of the various stations on the West coast. It was also used for radiotelegraph and fisheries inspection purposes.

The commanding officers of the Fisheries Protection ships on the West coast were required during the past year to issue permits or licenses to salmon trawlers, 227 of which were boarded by officers of the *Malaspina*, and 105 licenses issued.

The vessel rescued the captain and seven men from the wrecked tug *Queen*, and secured a boom of 800,000 feet of logs in safety.

The vessel also stood by *C.G.S. Givenchy*, ashore in Raven Cove, and accompanied her to Vancouver when floated off.

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Ballot boxes for the Federal elections were delivered to various places on the west coast of Vancouver island.

While patrolling the *Malaspina* surveyed and reported to the department three uncharted rocks and also made sketches of two unsurveyed harbours frequented by fishermen.

The vessel steamed 11,811 miles during the season and was under way 1,180 hours.

C.G.S. Thiépral.—This vessel was also on Fisheries Protection duties on the West coast.

The *Thiépral* seized the United States gas boat *Sylph*, of Alaska, and the Canadian boat *Rosina B.* of Prince Rupert, for smuggling liquor. The United States halibut boat *Rescue*, of Alaska, was also seized for fishing within the three-mile limit.

During part of the season the *Thiépral* took on board official photographers for the purpose of obtaining pictures of the halibut fisheries in Hecate strait. The vessel also carried out inspection duties for the Customs Department on the west coast of Vancouver island. Thirty-six permits to salmon trawlers were issued during the season.

The vessel was under way during the season 1,601 hours and steamed 13,191 miles.

The Fisheries Protection Service, including *C.G.S.S. Arleux, Arras, Becancour, Lavolette, Malaspina*, and *Stadacona*, were transferred to the Marine and Fisheries Department to date from June 30, 1922.

3. SURVEY OF TIDES AND CURRENTS

This survey has carried on its work successfully during the past year, and considerable addition has been made to the information on tides available for Canada. In Eastern Canada a series of new tidal stations was established during the season, chiefly in the New Brunswick region. On the Pacific coast the principal work carried out was on the main line of ocean steamships through Boundary pass and Haro strait, on the route from Vancouver to the ocean. The principal tidal stations both in Eastern Canada and on the Pacific coast have been inspected and repaired where necessary. These stations are thirteen in all, and are kept in operation summer and winter. There has also been published during the year a special report on the "Temperatures and Densities in the Waters of Eastern Canada," which has been compiled from all the observations obtained during a series of years, in connection with the investigation of the currents in various regions.

OBSERVATIONS OF CURRENTS DURING THE SEASON OF 1921

Observations throughout Boundary pass, which were commenced in the season of 1920 with a surveying steamer, were continued in 1921 by means of motor launches, as a steamer was not available for the purpose. Camps were established on the shore for the observers, and the observations obtained were limited to the time of the turn at slack water. The points at which the records were made were at East point of Saturna island, at Turn point, off Kellett bluff, and at the southern end of Haro strait off Discovery island. The observations thus obtained have been reduced to practical form by comparing them with the information obtained with the steamer, which enables the velocity and direction of the current to be ascertained, as well as the time at which it turns. The work in both seasons was under the direction of Mr. S. C. Hayden.

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The behaviour of the currents in this region is extremely complex, because the tide itself is undergoing rapid modification during its progress through the Gulf islands from Fuca strait to the Strait of Georgia. At the southern end of Haro strait, the current accords in a general way with the tide at Victoria, and at the other extreme off Saturna island it is related to the tide in the Strait of Georgia, which is entirely different in type. It has been possible, however, to determine the salient features in the action of the current at some of the stations above indicated, and this information will appear in the Pacific Tide Tables for next year. It has also been sent at once to shipping companies, pilots on the Pacific coast and others interested.

Further observations at intermediate points in the length of Boundary pass and Haro strait will be obtained during the coming season, with the hope of determining the laws which govern their action, in the endeavour to assist navigators in understanding them.

Observations of the current in Active pass were obtained again last season, as it appeared possible that the behaviour of the current in Boundary pass might accord with this other pass. This did not prove to be the case, however. The results obtained in Active pass are important, however, in showing that the values used for the calculation of slack water are as accurate as can be obtained, since the further observations accord very closely with the previous data.

In Eastern Canada the only observations of the current which were obtained were at Tracadie on the New Brunswick coast. This is a harbour of importance to fishing vessels and data for the turn of the current are valuable to them, as well as for the height of the tide on the bar in the event of their using this as a harbour of refuge during storms.

TIDAL OBSERVATIONS DURING THE SEASON OF 1921

The tidal stations established during the season in Eastern Canada were placed at the head of Chaleur bay, and at other points on the New Brunswick coast. Those in Chaleur bay were at Campbellton and Dalhousie, with a third station situated at Gaspé. On the open coast of New Brunswick the two stations established were at Tracadie and Buctouche. The object of these is chiefly to ascertain the character of the tide on this side of the Gulf of St. Lawrence, and also the point at the western end of Northumberland strait where the tides meet. It was thus definitely established that this meeting point is Buctouche, as the tides in the two directions from this harbour (namely, at Richibucto and Shediac) have opposite characteristics in regard to diurnal inequality, which is the dominant feature in this region. The determination of this meeting point will indicate the limit between tides of different types, and will throw light upon the progress of the tide in this region.

One of the important results obtained by such observations is a good determination of the low-water datum, where this is essential in dredging operations. A considerable amount of dredging of channels has been carried out, or is contemplated, at Campbellton, Tracadie and Buctouche. The possible extreme level to which the tide may fall is also valuable in this connection. These gauges were erected and the new observers were instructed in their duties by Mr. H. W. Jones.

Through co-operation with the Hydrographic Survey, observations of the tide were also obtained at Seven islands, Ellis bay in Anticosti island, and at Amherst harbour in the Magdalen islands. Also, on the Pacific coast, tidal data were obtained at two new localities with tide gauges supplied to the Hydrographic Survey. One of these is near the northern end of Vancouver island at Quatsino sound, and the other on the mainland side of Hecate strait.

On the Fraser river, registering tide gauges of an improved type have been supplied to the Public Works Department, as the gauges originally designed for that important waterway were worn out. These have been placed at Garry point at the entrance to the Fraser river and at New Westminster. The tidal record thus obtained will eventually be forwarded to this Survey, after the Public Works Department has obtained from it the essential data which they require.

HUDSON BAY AND LABRADOR

In the early spring of 1921 arrangements were made with the Hudson's Bay Company to establish two tidal stations on the eastern coast of the Bay, where no tidal information is at present available, and to place a third station at Amadjuak in Hudson strait, which is a new locality that it is intended to develop. The necessary arrangements for this are to be made by the courtesy of the Superintendent of Bay Transport, and the gauges when erected will be in charge of Hudson's Bay Company agents. It is thus hoped to obtain tidal information on a stretch of some six hundred miles in a new region, when the record from the tide gauges is received.

Hamilton Inlet.—The expedition to this inlet, which was sent out by the Naval Service Department, was furnished with registering tide gauges and the necessary equipment by this Survey. If there had been more time better arrangements could have been made for the establishment of a reference station on the open coast, with which the tide in the inlet could have been correlated. The deficiency in this respect has made the reduction of the observations a much more difficult problem but some valuable results have nevertheless been secured. One of the most important of these is the discovery that the tide corresponds with Halifax, so far north on the open coast of the Atlantic. The difference in the time of the tide is more constant with Halifax than with other of the Canadian reference stations.

The gauges placed at various points throughout the inlet were erected and supervised by the Hydrographic Survey. The observations were obtained with registering gauges at Broomfield island, east of Rigolette, Caravalla cove above Rigolette, and two others in Melville bay and Goose bay. On the open coast at Indian harbour and at Rigolette itself, scale readings only were obtained and not the continuous record which a registering gauge would have afforded. It was thus necessary in making tidal comparisons with ports of reference to base them upon the record obtained at Broomfield island which was continued for 1½ months. Simultaneous comparisons with Halifax were also based on the record obtained at Caravalla. The observations at Rigolette were then compared with Broomfield and Caravalla in the two directions and a mean of the two taken as the final result for Rigolette itself. The observations further up the inlet, in Melville and Goose bays, were compared with Caravalla; as the small rise of the tide made the time of high water and low water rather indefinite. The greatest range at spring tides is at Indian harbour where it amounts to 6½ feet.

The results obtained for Hamilton inlet were communicated to the Marine Department of the Newfoundland government and to steamship and fishing companies in Newfoundland which trade with that region.

PUBLICATION

The two main editions of the tide tables and the three abridged editions have been prepared and issued as usual. A considerable amount of new information has been embodied in these, based upon further tidal observations as above indicated. The rise of the tide throughout the St. Lawrence estuary below Quebec has been revised on the basis of all information now available, and other additions and further explanations have been added. The circulation of these tide tables is well maintained with some increase in the various editions.

A special publication has also been prepared by the superintendent entitled, "Temperatures and Densities of the Waters of Eastern Canada," based upon investigations by the Tidal Survey in the seasons of 1894 to 1896, and 1903 to 1911.

The densities and temperatures of the water in the Gulf of St. Lawrence, the Bay of Fundy and other regions off the shores of Eastern Canada and Newfoundland, as here published, give the whole of the information of this character which has been obtained to date by the Tidal and Current Survey in these waters. The primary object

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in view in taking the observations was to trace the currents and slower movements of the water by these characteristics and in the various reports on currents issued by the Survey, some partial publication has been given from this point of view; but in the present comprehensive form, it may better serve to indicate the character of the waters themselves on these coasts of Canada, and their variations in regard to locality and to change with the progress of the season. This may also be of value in its bearing on the distribution of fish and other marine life, both locally and during the course of the season.

The extended observations in Cabot strait, the Gaspé region and the northeastern arm of the Gulf towards Belle Isle strait, agree in showing that there is a cold layer of water at a depth of 40 or 50 fathoms which remains practically at the freezing point to the end of the season. The warming of the surface water with the progress of the season does not therefore appear to extend beyond a depth of 30 fathoms.

In consequence of this there are extensive bottom areas in the Gulf, running in belts parallel with the shore, which must remain at the freezing point throughout the year, as well as some of the banks which lie at a depth of 30 to 50 fathoms. This no doubt has a bearing upon marine life.

In the deeper channels in the Gulf area, in which the depth runs from 100 to 250 fathoms, the water is distinctly warmer as well as higher in density. This is shown clearly in the more comprehensive tables of deep temperatures and densities in this publication.

Further points of interest are the temperature of the water as it affects the spawn of fish and its hatching, and the dilution of sea water by fresh water, represented by its density, which affects some types of marine life. The consideration of these points will show the depth to which it is necessary to carry observations of temperature and density in this connection.

The spawn of most fish of commercial importance floats on the surface. It is thus directly related to the surface temperature. As to the effect of cold water on hatching, it is generally held by the authorities, that it provides more favourable conditions for the healthy larval development of sea fishes.

The chief bottom spawn is herring and it does not probably extend beyond a depth of 10 or 20 fathoms. Investigations of the water to a depth of 20 fathoms might therefore be sufficient as there is rarely bottom spawn beyond this limit. The depth of 30 fathoms to which these observations of temperature and density were ordinarily taken should thus be ample from this standpoint, as well as for the fresh water influence in ordinary bays and estuaries, which would have any appreciable effect upon shellfish or other marine life.

Some examples are given of the effect of the wind in displacing the warmer water on the surface, after it has warmed up with the progress of the season. Strong off-shore winds may drive the warmer surface water into the offing and allow the cold under-water to come to the surface and replace it. Similar conditions may explain the belt of colder water which not infrequently occurs along the shore, which appears to be due to the off-shore direction of the prevailing winds. At the entrance to the Bay of Fundy where islands and shoals are numerous on the Nova Scotia side, the general effect of the strong currents is to chill the water in the vicinity of the coast by mixing the surface with the colder water from below. It is possible that this lowering of the surface temperature may have a bearing on the formation of fog in this region.

In Belle Isle strait, opportunities were taken to investigate the question of the lowering of the temperature of the water by icebergs. One large iceberg, which was grounded in the strait, was examined in a boat, and the temperature of the surface water was taken close round it on different sides. It was found that the water was chilled by only one-half degree on the side from which the water was tailing with the flood current.

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Another large iceberg, which was aground near the eastern end of the strait in 57 fathoms of water, showed a lowering of temperature of less than 2° in its proximity, and in another instance this lowering only amounted to 1° .

It is evident that such small difference of temperature found closer to icebergs than a steamer would willingly venture cannot be relied upon as an indication of value, to show that icebergs are near. It was also found that a strong off-shore wind can occasion a greater change in the surface temperature than ever occurs from any other cause. After a gale, a vessel might thus find colder water near the shore than it would meet with in the vicinity of an iceberg, relatively to the general average temperature of the surface water in the region.

CO-OPERATION AND INFORMATION SUPPLIED

The amount of information asked for from this Survey is always increasing, as the Survey becomes more widely known and as the need for new information extends. When any new works are undertaken in our harbours one of the first things required by engineers in designing them is to have data for the tide levels and the extreme rise of the tide. Such information was furnished in connection with the proposed dry-docks in Vancouver and in Esquimalt. The results obtained by the investigation of tides and currents are always communicated to the British Hydrographic Office. In this way it appears in the British tide tables and navigators have the advantage of it on their first voyage to Canada, before obtaining our tide tables. The revised value for the rise of the tide throughout the St. Lawrence estuary was thus communicated: the character of the tide in the region of Miramichi bay; the results obtained for Hamilton inlet and descriptions of the behaviour of the currents in the passes and straits of the Pacific coast obtained from recent observations. Such information will be embodied in the British tide tables or it will appear in the sailing directions issued by the British Admiralty, which gives wide publicity to it.

Co-operation is also maintained with the Hydrographic Survey in its work both in Eastern Canada and on the Pacific Coast. The endeavour is made to determine a suitable low-water datum in advance of their surveys so that the reduction of soundings can be definitely made from the outset, without the need of beginning with a provisional datum which might afterwards require to be modified. On the other hand the Hydrographic Surveyors have been very willing to co-operate with this Survey in obtaining further tidal observations at new localities, to which it would be inconvenient to send one of the Tidal Survey Staff, while carrying on work elsewhere.

This Survey has also maintained cooperation with the engineers of the Public Works Department and has utilized the low-water datums established by them wherever practical, especially where the datum has already been used for dredging purposes. In cases where the datum is actually unsuitable, the Public Works engineers have always been ready to modify it in accordance with the better determination that can be arrived at from more extended observations. The Geodetic Survey of Canada has also been obliging in modifying the route of their lines of levelling in order to establish bench-marks, which can be used for reference in tidal work. Arrangements are also being made with that Survey to connect points on the coastline of the Bay of Fundy with their through lines of levelling. This will enable the tidal observations in the upper part of the Bay of Fundy to be brought to true elevations and compared accurately with each other at different localities, which will throw additional light upon the nature of these very important tides. This Survey is also careful to send out promptly any new results arrived at for the benefit of navigation. Some instances of these have already been referred to. It can usually be done without the expense of printing by some extra work in typewriting in the office, or by mimeograph reproduction. In this way the captains of vessels are provided with information in advance of its publication in the tide tables.

INTERNATIONAL RESEARCH COUNCIL

In the spring of 1922 the International Research Council arranged to hold a conference at Rome. This Council was called to consider questions of astronomy, geodesy and oceanography. Dr. W. Bell Dawson, Superintendent of Tidal and Current Surveys, was delegated by the Canadian Government as its representative for the consideration of matters of oceanography.

The conference was held in Rome from the 2nd to the 12th May, 1922. This conference was of special interest because an endeavour was made for the first time to unify the whole subject of dealing with the action of tides and currents. While in Europe, Dr. Dawson also discussed with a number of other eminent scientists the question of improving methods of tidal and current calculation.

The Tidal and Current Survey Branch was transferred to the Department of Marine and Fisheries on June 30, 1922.

4. HYDROGRAPHIC SURVEY

The Hydrographic Survey has charge of surveying the navigable waters of the Canadian rivers and coasts. Field parties operate each season in various localities, taking soundings and preparing other information. From the information compiled, charts are prepared which are available for purchase from the head office of the Hydrographic Survey at Ottawa. Charts have been published for the Great Lakes, the St. Lawrence waterway and tributaries, and for Eastern Canada and British Columbia coast waters.

During the summer of 1921 the following surveying parties were in commission: Atlantic Coast, Lower St. Lawrence, Magdalen Islands, Pacific Coast, Pacific Coast Auxiliary.

Atlantic Coast

Captain F. Anderson, with his assistants, left Ottawa on May 29, joined the *Acadia* at Halifax and proceeded to sea on June 2. Work off Cape Canso, which was uncompleted in 1920, was continued, the party working to the northeast off the southeast shore of Nova Scotia. Owing to continued fog little progress was made during the first month.

Early in June, the Department of Justice requested the Department of Naval Service to undertake a survey of lake Melville, an extensive body of water at the head of Hamilton inlet, Labrador, and the work was allotted to the Atlantic Coast Survey party. In order that it could be completed within the season, the party was enlarged by the addition of three officials and by transferring a shore party working at Seven islands. Additional seamen and gasoline engineers were also engaged. The party thus enlarged left Halifax on July 3.

Accompanying the party was a representative from the Department of Justice and a party under Dr. Kindle, of the Department of Mines, who had been commissioned to procure other information for the Department of Justice. The *Acadia* reached Hamilton inlet on July 13 and a staff tide gauge was immediately erected at Indian harbour.

At Rigoulette, the Hudson's Bay Company post at the head of Hamilton inlet, two shore parties were made up, one to make a survey in detail on a large scale of the narrows connecting Hamilton inlet with lake Melville, and the other to carry on survey work in the vicinity of Carter basin. Suitable accommodation on shore for both these parties was found.

Dr. Kindle and his party also left the ship to carry out his work independently of the steamer, and the representative of the Department of Justice was supplied with a launch to carry out his explorations and left the ship at Northwest river.

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The surveying party at Carter basin established automatic gauges at Epinette point and at the east extreme of Rabbit island to determine the tidal effect above and below the Goose bay narrows. They also traversed Goose bay and the upper part of lake Melville and sounded out that body of water, and made observations for tides and measured the currents therein. Water samples for salinity were taken in various places.

The regular survey work from the steamer started immediately, bases were measured, a triangulation was carried from one extreme to the other, signals were erected and a detailed traverse was carried out and the lake was thoroughly sounded. As a result of this survey an accurate chart of lake Melville is now to be had.

On September 25, the Carter basin party completed their work and rejoined the ship and on September 28 the party working in the Narrows connecting Hamilton inlet and lake Melville were picked up.

The party proposed, in addition to the above-mentioned work, to make some examination of the outer Labrador shore and if possible "fix" the position of the range of hills paralleling the coast. This work was not undertaken because the coal ordered failed to reach the *Acadia* in time and there was barely enough fuel on board to enable the steamer to reach the strait of Belle Isle. The coaling schooner was met at port Saunders, Newfoundland, where the *Acadia* coaled up and continued to Halifax where she arrived on October 17.

During the season, weather in lake Melville was fair, few days being wholly unfit for surveying work. After August 1 heavy squalls were experienced and a great difference in temperature was noticed between the lake and Hamilton inlet, it being quite warm on the lake, and owing to the presence of ice, very cold outside. Black flies and mosquitoes were exceptionally numerous and troublesome.

Upon arrival at Halifax, the extra assistants proceeded to Ottawa, superfluous gear was landed and the extra seamen and boat engineers were paid off. The ship then proceeded on October 21 to cape Sable, Yarmouth and St. John. The balance of the month was occupied in sounding off cape Sable and running trial lines across the Bay of Fundy. About 600 miles of soundings were taken in this area. These when plotted on the Admiralty chart, agreed quite closely with the old soundings and showed that the reports of inaccurate soundings were not justified.

The Direction Finding Station at Red Head, St. John, N.B., was calibrated and the operator of the station was furnished with a true bearing of Lurcher light-ship.

On November 3 the Direction Finding Station at Chebucto was calibrated. Upon arrival at Halifax the crew was paid off and the ship was laid up for the season.

As a result of the ice encountered in the northern waters, the vessel was docked and painted for preservation during the winter. Upon examination the hull was found in good condition, very little pitting having developed.

Several uncharted shoals were located off County harbour and Whitehead (south-east coast of Nova Scotia), in the early part of the season and Notices to Mariners concerning these were issued.

In lake Melville an area of 910 square miles were sounded, involving 500 miles of line sounding from the ship's deck and 1,000 miles from the boats and launches; 414 miles were traversed and eight rivers were examined for tidal influence.

The samples of water taken for salinity were transferred to the proper authorities in the Fisheries Branch of the Department of Marine and Fisheries and reports thereon will be turned over to the Department of Justice.

LOWER ST. LAWRENCE

Mr. Charles Savary was in charge of this survey and used the steamer *Cartier*, which went into commission on May 21, 1921, and started work off the northeast end of Gaspé peninsula.

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A detached party carried out a resurvey of Seven islands until the time it was transferred to the Atlantic Coast Survey for work at Lake Melville. The Lower St. Lawrence party continued survey work throughout the season in the Gaspé area until October 2 when the steamer was laid up. Appendix 1 of this report gives particulars of a new method of sounding which has been developed by this survey.

MAGDALEN ISLANDS

C.G.S. *Bayfield*, in charge of Mr. R. J. Fraser, which had been in previous years used on the Great lakes, was transferred to the Magdalen islands, as the work of the Great Lakes was for the time being completed.

During the cruise from lake Superior to Magdalen islands a new shoal off the entrance to Georgian bay, in the vicinity of Cove island, was located. The boundary monuments in the vicinity of St. Clair river which were, by Order in Council, placed under the jurisdiction of the Hydrographic Survey Branch and which had been disturbed by the building of new roads, were relocated.

On the cruise through the St. Lawrence, small surveys were made of the upper entrance to Cornwall canal, where some shoals were reported and where shoals dredged out had not been recorded. A small resurvey was also made of the upper entrance to Lachine canal with a view of determining the spot on which a steamer had touched in the previous autumn.

The *Bayfield* reached Magdalen islands on July 2, where the survey work was immediately undertaken. The usual triangulation was carried out and large scale plans of Amherst, Grindstone and Grand Entry harbours were made.

Tidal records were obtained and bench marks established at three places, and information was turned over to the Tidal and Current Survey Branch.

In August, assistance was rendered to a reconnaissance party of the Geodetic Survey, with a view to locating triangulation points necessary for their work. Owing to difficulties over fresh waters and long periods of heavy winds the work was very much hampered and it was decided to discontinue operations in exposed waters on August 24.

The party then moved to Miramichi bay, where triangulation was carried out and connected with the survey work of the Public Works Department in Miramichi river. The greater part of the sounding of the outer bay and the entrance channels was completed and noticeable changes in the dredged cut of the ship channel in the outer bay were found since the last survey in 1885.

The vessel was laid up on October 28, 1921, and the surveying parties returned to Ottawa.

During the season the party sounded from the ship 383 miles and from boats 465 miles, in addition to 22 miles of traversing.

The following Magnetic variations were obtained in the vicinity of the Magdalen islands:—

Amherst harbour.. . . .	27°02' W.
House harbour.. . . .	27°04' W.
Pleasant bay.. . . .	27°03' W.
Grand Entry.. . . .	27°00' W.

PACIFIC COAST

This branch of the Survey is under the immediate charge of Mr. H. D. Parizeau, who uses C.G.S. *Lillooet*, whilst a smaller party is housed on the small auxiliary steamer *Restless*, in charge of Commander J. H. Knight, R.N.

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The *Lillooet* was commissioned on May 1, and survey work, between the 3rd and 11th, was carried on sounding south of Victoria, in the strait of Juan de Fuca.

This work having been completed both steamers left Victoria on May 13 and reached Menzies bay (Seymour narrows) on May 15.

A survey of Ripple rock in the middle of Seymour narrows was requested by the Department of Public Works, and because the currents here are very strong and slack water exists only for a few minutes at each tide, Mr. Parizeau decided to use the whole party to carry this operation through, between May 15 and 25. A very fine delimitation of this dangerous obstruction was obtained.

On the 26th, the *Lillooet* reached Quatsino sound and gave some help to Commander Knight in determining positions at the outer entrance to that body of water and at the same time sounded some of the deeper water in the approach. The *Lillooet* left Quatsino on June 2, and reached Queen Charlotte city the next evening. Owing to the non-arrival of some expected gear the party was forced to abandon plans for survey work in the middle of Hecate strait and to take up quarters off Banks island where the season was spent in surveying both in traversing and sounding, an area of 420 square miles.

Owing to the inclement weather the party left Queen Charlotte islands on October 28, and again visited Vancouver to ascertain what shoal spots in First narrows had been removed by the Department of Public Works during the summer and found that most of them had been removed so that a depth of 30 feet may be carried through First narrows with the exception of a small spot marked Parthia shoal. Esquimalt was reached on October 11 and the crew was paid off.

Up to August 1 the weather was fine but after that more than half time was lost through wind and rain. During the season 62 miles were traversed, 482 miles boat sounding and 852 miles ship sounding was done.

After the departure of the *Lillooet* from Quatsino sound, Commander Knight continued his survey of that water and had almost completed it by the end of the season. The party reached Victoria on October 6 and proceeded to lay up. On account of the exposed nature of the coast at the entrance to Quatsino sound the work suffered much interruption by southeast gales and rain so that on the whole more than quarter of the time was lost by weather conditions. Several new rocks have been discovered in this important sound and "Notices to Mariners" relating to them have been issued.

AUTOMATIC GAUGES

This important branch of the Survey is in charge of Mr. Price. As in previous seasons 33 automatic gauges were operated. This season 22 of them gave records during the whole year. Requests for results from these automatic gauges continue to increase and are becoming more valuable on account of the length of the time the gauges have been in operation. Following is a table giving the mean water surface elevations at each of the stations where gauges were in operation.

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During the past year the following new engraved charts were issued from this office:—

- No. 412—New Gulf Telegraph Chart.
- No. 314—Humboldt Strait.
- No. 205—South Channel.
- No. 315—Victoria harbour.
- No. 110—Caribou island to Michipicoten island.
- No. 316—Esquimalt harbour.

The following charts were placed in the engraver's hands:—

- No. 206—The Traverses.
- No. 105—Gargantua and Michipicoten harbours.
- No. 212—Plans of harbours, St. Lawrence river.
- No. 213—Cap Magdalen to Pointe des Monts.
- No. 109—Cape Gargantua to Otter head.
- No. 115—Lake Superior (general chart).
- No. 79—Lake Huron (general chart).
- No. 76—Lake Erie (general chart).

The following charts were placed in the lithographers' hands:—

- No. 12—St. Lawrence river (Bécancour to Champlain).
- No. 19—St. John harbour.
- No. 312—Granby bay Alice arm and approaches.
- No. 15—St. Lawrence river (Cap Lévrard to Ste. Emmelie).
- No. 420—Lake Melville.
- No. 18—St. Lawrence river (Ste. Croix to St. Antoine).
- No. 17—St. Lawrence river (Portneuf to Cap Santé).

The following reprints were received:—

- No. 1—St. Lawrence river (Montreal to Longue Pointe).
- No. 50—Lake St. Louis.
- No. 418—Cape Tormentine to Port Borden.
- No. 95—Meldrum point to St. Joseph channel.
- No. 90—St. Clair river to Goderich.
- No. 53—Lake St. Francis, western portion.
- No. 91—Goderich to Chantry island.
- No. 305—Masset sound and inlet.
- No. 75—Long Point bay.
- No. 72—Goderich harbour.
- No. 12—St. Lawrence river (Bécancour to Champlain).
- No. 84—Parry Sound and approaches.
- No. 52—Lake St. Francis, eastern portion.
- No. 83—Waubushene to Western island.
- No. 86—Georgian bay to Clapperton island.
- No. 100—Georgian bay.
- No. 313—Approaches to Skeena river.
- No. 7—St. Lawrence river (Ile aux Foins to Ile de Grâce).
- No. 101—Head of Thunder bay to Pigeon river.
- No. 62—Newcastle harbour to Toronto.

There are now issued by this survey 130 charts of various parts of Canadian waters and the demand therefor, shows a substantial increase.

A new edition of the Catalogue of Charts, with Index Maps has been prepared and is about ready for issue.

Owing to an arrangement with the Printing Bureau a departure has been made with regard to the engraving, in that a part of the staff from that office has been transferred directly to the Hydrographic Survey office and the engraving is done now in close conjunction with the draughting room. This saves time and although the system has not been in use very long it is felt that better results are being obtained.

The Hydrographic Survey Branch was transferred to the Department of Marine and Fisheries on June 30, 1922.

APPENDIX I

NOTES ON THE USE OF WIRE FOR SHIP SOUNDING

As the resurvey of the lower St. Lawrence progressed towards the gulf, with the increasing depth of the river there grew yearly a corresponding increase in the amount of ship sounding to be done and the standard apparatus employed, though suited to the moderate depths in the upper portions of the river, was found to be neither speedy nor economical.

Sounding from the ship had been carried on to depths of 60 and 70 fathoms by means of the regular deep-sea line with a "Walker's Harpoon Sounding Machine" attached, with which soundings may be obtained with the ship under way. Beyond this depth the Lucas steam sounding machine was used, the employment which meant bringing the ship to a standstill, with a consequent loss of time, and if in a tidal stream, the ship drifting out of position. The deep sea line employing the Walker's machine has of late years been of inferior quality and unable to stand the strain from the heavier leads and greater depths.

To devise a speedy and more economical method of sounding in the deeper water, experiments were carried on, using a wire instead of the deep sea line, in depths of about 250 fathoms. These proved successful, and for the past two seasons practically all the ship sounding on the lower St. Lawrence was done with a wire and the apparatus of which the following is a detailed description:—

The submarine sentry as manufactured by Cowbro and Scrutton, was used as a sounding drum and proved to be very satisfactory for the purpose. It possesses sufficient strength for constant daily use; its drum is well balanced, easily rotated, and is large enough to carry five or six hundred fathoms of wire of the size used. It has a strong friction band brake which readily controls both the descent and the heaving in of the sounding lead.

The submarine sentry is a two-speed winch. To take a cast the main drum is thrown out of gear and rotates freely through the action of the sounding lead dropping. For heaving in, a pulley on the end of the high power geared spindle is connected by a swifter to a steam winch, or preferably by a belt to an electric motor.

Two different kinds of wire were employed. One, the Thompson Sounding Machine standard 7 strand, flexible steel wire, diameter .06 of an inch with a 45 pound sounding lead; and the other the regular one-strand submarine sentry wire and with it a lead weighing 65 pounds. The outer end of the wire had a swivel and to this was attached the registering apparatus. This was the Walker's Harpoon Sounding Machine with lead attached, and thus arranged it was found to operate very satisfactorily. The particular Walker's Sounding Machine in use last summer showed an error of 4 per cent, this error being constant for all depths sounded.

To take a cast with the submarine sentry and sounding machine thus arranged, the friction brake on the sentry was released freely and the lead and wire sank at a uniform rate of about 18 feet per second. There was practically no tension on the wire, as was evidenced by its going down in a wavy line. The ship was kept under way ahead at a speed of 7 knots, and in a depth of 200 fathoms the lead took about 70 seconds to reach the bottom. At this speed of the ship and depth of sounding the length of wire paid out was 315 fathoms. The lead having reached bottom, it was hove in at the rate of 8 feet per second. The total time consumed in obtaining the sounding was 5 minutes, and in this time the vessel travelled about 6 cables.

To check the accuracy of the result and guard against errors due to the machine as thus used, a registering dial was connected to the main drum of the sentry. The dial registered the length of wire paid out. The ship's speed was kept as constant as possible, by means of the engine revolutions, and a constant soon derived, which.

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when applied to the length of wire paid out, gave the vertical depth, or sounding. By this means the check on the accuracy of the Walker's Harpoon Sounding Machine was obtained.

The wire used weighed about 16 pounds per 1,000 feet, and with 300 fathoms paid out and hove in at the rate of 8 feet per second, the tension of the wire was found to be 125 pounds.

With no difficulty casts of over 225 fathoms were obtained with this sounding apparatus whilst the ship was travelling at a speed of 7 knots.

The principal advantages gained in the use of this apparatus for ship sounding are: greater ease and less difficulty in holding the ship to the desired course and line to be sounded, an increase in the daily mileage of soundings, and economy of fuel. The vessel can be kept at a uniform, economical speed and sound a larger area in a day, and with less expenditure of fuel than used in the older method of sounding where a higher maximum speed was maintained between soundings and the vessel stopped and engines reversed at every cast of the lead.

5. RADIOTELEGRAPH SERVICE

The work of the Radiotelegraph Branch comprises the design, construction and operation of stations on the East coast, Great Lakes, Hudson bay and West coast; the licensing of all private radio stations in Canada and on Canadian ships; the inspection of all licensed stations in Canada and ships plying to Canadian ports to see that they are complying with the International and Canadian regulations, and in the case of ships to see that they comply with the section of the Radiotelegraph Act which calls for the compulsory equipment on certain classes of passenger vessels irrespective of nationality carrying Canadian passengers; the examination of all commercial and amateur operators for certificates of proficiency in radiotelegraphy and the administration of the Radiotelegraph Act.

The primary object of the Radiotelegraph Service is to provide facilities for communication with ships at sea and thus assist in their navigation and the safeguarding of the lives of people they carry. The service also undertakes the handling of commercial messages with ships and also provides means of communication with points not reached by existing land telegraphs, a notable instance of the latter being the Queen Charlotte islands.

The existing service comprises nine stations on the Pacific coast, eight on the Great Lakes and twenty-three on the river St. Lawrence and East coast, including four Direction Finding stations. There are also two stations at Lepas and Port Nelson, Man., respectively, which are temporarily closed. A commercial service with Bermuda is provided via the station at Barrington Passage, N.S., which station also maintains a "long distance" service to ships at sea.

All of the thirty-seven coast stations (that is stations for communication with ships at sea) and the land stations at Lepas, Man., are owned by the Government. Those on the Pacific coast, Hudson bay, Halifax dockyard, Barrington Passage, N.S., and the four Direction Finding stations on the East coast, seventeen stations in all, are operated directly by the Department of the Naval Service, the stations on the Great Lakes and the remaining stations on the East coast, twenty-five in all, are operated by the Marconi Wireless Telegraph Company of Canada, Limited, under contract.

The four Direction Finding stations on the East coast in connection with the navigation of ships at sea continue to give satisfactory results. These stations have undoubtedly prevented wrecks and are a most useful and reliable aid to navigation. The operation of these stations requires a highly skilled and experienced staff, and from numerous letters received by the department it would appear that the service

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given by the Canadian stations would compare favourably with that given by similar stations in the United States, England and other countries. That the service is appreciated by navigators is demonstrated by the number of bearings asked for. Cape Race, for instance, has given as many as forty ships their bearings in a single day.

The scheme of dividing the ten stations on the Pacific coast into two groups, one to handle "ship to shore" business and the other "interstation" or ordinary telegraphic business, proposed last year, is being proceeded with, this reorganization being essential for the preservation of the efficiency of the "ship to shore" service, which is seriously congested with ordinary telegraphic business. Under this scheme the low-power station at Ikeda Head was closed on September 15, 1920, and the low-power station at Pachena Point temporarily closed on October 23, 1920. Similar action with regard to the Cape Lazo station will be taken as soon as possible, with consequent saving in running expenses. These three stations have been in operation since 1909, but the greatly increased range of modern ship sets now permits the closing of them without impairment of service.

The power of the Estevan Point station, on the west coast of Vancouver island, was increased to provide adequate facilities for communication with trans-Pacific ships fitted with modern apparatus. Operation of the station on storage battery was commenced on March 27, 1922, with excellent results.

It is proposed to erect a complete new station in the vicinity of Vancouver to act as a terminal station for the inter-station group, thus relieving the congestion which now exists at Point Grey; the work of the latter station would, on completion of the new Vancouver station, be confined exclusively to ships. The proposed new station will have sufficient range to work directly with a similar station on the Queen Charlotte islands and with any other point on our Pacific coast.

The Government owned and operated station at Barrington Passage, N.S., continues to provide a commercial service with Bermuda on a wavelength of 4,200 metres C.W. and a long-distance commercial service with ships at sea. This station maintains continuous watch on 2,400 metres C.W. except during commercial traffic routines with Bermuda at 12.30, 4.30, and 8.30 a.m. and p.m. G.M.T., and during H.M. ship watch routines on 2,400 metres for fifteen minutes commencing 0245 G.M.T. and every subsequent four hours. Barrington also transmits weather forecasts on 1,600 metres sparks at 1.30 and 13.30 G.M.T. The department has continued its policy of maintaining the apparatus on the different stations up to date and the service continues to maintain a degree of efficiency which compares favourably with that obtained elsewhere.

The administration of the Radiotelegraph Act with which the department is charged has been carried on as usual and no evasions or attempted evasions of section (4) of the Radiotelegraph Act, calling for the compulsory equipment of Radiotelegraph apparatus on certain steamers have been reported. The following amendment has been made to the Radiotelegraph Regulations:—

Radiotelegraph Regulation No. 104. Amendment. Paragraph (i) of section (a) of Radiotelegraph Regulation No. 104 is hereby cancelled and the following is substituted therefor, effective February 15, 1922:—

(i) When direct communication by messenger, visual signals or other method between ship and shore is impracticable and then only for the purpose of exchanging with the nearest coast station messages relating exclusively to the business of the ship.

A Radiotelegraph Inspection Service is maintained by the department and vessels are regularly inspected to see that the law is being complied with.

Permanent inspectors are maintained at Victoria, Ottawa, Halifax, Montreal (summer), and St. John (winter). These inspectors in addition to inspecting all ships and licensed stations in their district, also undertake the examination of operators for certificates of proficiency.

All land stations are inspected at least once a year and all ships whenever they are in port. Examinations of operators are held at the above points and at other centres when a reasonable number of candidates can be gathered together.

Part-time inspectors are maintained at Winnipeg, Man., and Charlottetown, P.E.I. The following table shows the number of inspections made during the fiscal year 1921-22:—

Coast stations and land stations..	35
Ship stations..	1,285
Amateur stations	110
Total..	1,430

The service undertakes the auditing rendering and collection of accounts for commercial ship to shore messages, commercial interstation messages and the commercial service between the United States, Canada, and foreign points and Bermuda via Barrington Passage, N.S., also the auditing rendering and collection of accounts to various operating companies and foreign administrations for radiotelegrams exchanged by foreign ships through Canadian coast stations and the auditing, rendering and collection of accounts to various domestic and foreign operating companies and foreign administrations for radiotelegrams exchanged by vessels of Canadian registry through foreign coast stations. The following table shows the amount of paid business involved:—

	Paid business between ships		Paid business between stations	
	Messages	Words	Messages	Words
East coast	54,711	712,188	20,305	504,144
Great lakes.....	12,935	186,727	1,567	24,158
West coast	12,731	187,652	55,253	1,007,889
Totals	80,377	1,086,567	77,125	1,536,191

The Marconi contracts cover the operation of thirty Government-owned coast stations on the Great Lakes and East coast of Canada. The original contracts were entered into from time to time as the stations were built commencing in 1904, and in 1911 they were consolidated into one contract dated April 6, 1911, covering twenty-one Government and one Marconi station on the East coast. A supplementary contract, dated September 17, 1912, was afterwards entered into for the maintenance of eight Government stations on the Great Lakes.

Sixteen of the above stations are operated the year round, fourteen during the season of navigation only.

In 1919 the Board of Conciliation appointed to settle wage disputes between the Marconi Wireless Telegraph Company and its employees, awarded the employees an increase of practically one hundred per cent (100%). The board also recommended that Government subsidies be increased to meet the additional cost.

The contracts of 1911 and 1912 were amended by Order in Council of August 31, 1921, which provided that—

- (1) All redundant stations be closed (estimated at 6).
- (2) Subsidies in respect of the 24 stations remaining open be increased for a period of five years, commencing April 1, 1921, from an average of \$2,081.33 per station to \$5,500 per station.

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(3) Government pay one-half regular rates on Government messages.

(4) At the expiration of 1926, existing contracts again become effective.

On July 1, 1922, the Radiotelegraph Service was transferred from the Department of Naval Service to the Department of Marine and Fisheries. During the three months ended June 30 owing to the developments of the radiotelephone and the inauguration of Radiotelegraph Broadcasting stations, the number of Amateur Experimental licenses showed a great increase. On June 30, 3,741 Amateur Experimental stations were licensed by the department, and total number of Stations of all descriptions operated under license of the Department was 4,152; 740 were Radiotelephone Broadcasting stations varying in range from purely local stations with a radius of ten miles to those with a radius of 250 miles. The wavelength band reserved for broadcasting stations is 400 to 450 metres and no other work is allowed on this band in Canada.

Up to June 30, 1922, 2,588 licenses for reception only were issued.

To meet the large demand for receiving licenses arrangements have been made with the Postmaster General whereby the postmasters in the larger towns and cities of the Dominion are now issuing receiving licenses. This arrangement has proved satisfactory.

AMATEURS' REGULATIONS

The Amateur Radio Transmitting stations continue to develop, 1,153 transmitting licenses having been issued to the end of June. The class of apparatus installed indicates that the amateurs are keeping up with all the latest developments, and it being considered desirable that the regulations in so far as amateurs are concerned should be revised and amended to cover the latest developments, a questionnaire was sent to all Amateur Associations and other interested persons and their views obtained on the points under discussion.

As a result of the above some amendments to the regulations have been drafted and will be placed in effect at an early date. Pending the above Amateur stations have been authorized to use a wavelength of 180 metres for spark and 200 metres for C.W., and the normal Experimental wavelength has been established as 275 metres, and Amateur Broadcasting license has also been established under which recognized Amateur Radio Associations and Clubs may broadcast on a wavelength of 250 metres.

The general policy of the department in regard to Amateurs is that it is felt that the regulations should be made as few and as flexible as possible and amateurs should be given every encouragement to regulate themselves rather than have the department do it.

FEES FOR EXAMINATIONS AND LICENSES

Effective June 30, 1922, the following new rates for examination and license fees were established:

1. *Fees for Licenses.*—The annual fees to be paid in respect of licenses issued by the Minister of the Naval Service for the installation and operation of radiotelegraph stations in the Dominion of Canada, or on board any ship registered in Canada, shall be as follows:—

1. Limited Coast station.. . . .	\$50 00
2. Public Commercial station.. . . .	50 00
3. Private Commercial Broadcasting station.. . . .	50 00
4. Private Commercial station.. . . .	10 00
5. Experimental station.. . . .	5 00
6. Amateur Broadcasting station.. . . .	5 00
7. Amateur Experimental station.. . . .	1 00
8. Private Receiving station.. . . .	1 00
9. Technical or Training School station.. . . .	5 00
10. Ship station.. . . .	1 00

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2. *Fees for Examinations.*—The fees to be paid in respect of examinations for “Certificate of Proficiency in Radiotelegraphy and Radiotelephony” shall be as follows, for each examination or re-examination:—

1. Extra First Class certificate.. . . .	\$5 00
2. First Class certificate.. . . .	2 50
3. Second Class certificate.. . . .	1 00
4. Third Class certificate.. . . .	1 00
5. Experimental certificate.. . . .	2 50
6. Amateur certificate.. . . .	0 50
7. Emergency certificate, any class.. . . .	5 00
8. Radiotelephone certificate.. . . .	2 50

From April 1 to June 30, 69 examinations were held, including 17 re-examinations; 32 passed and 37 failed.

INSPECTION

In the three months period ended June 30, 1922, 52 Amateur stations and 487 Ship stations were inspected.

PERSONNEL

The personnel of the Radiotelegraph Service during the past year was as follows:—

GOVERNMENT SERVICE—

Headquarters	26
Coast stations.... .	67
Land stations.. . . .	38
Ship stations.. . . .	7
	<hr/>
	138

COMMERCIAL -

Headquarters.. . . .	90
Coast stations.. . . .	101
Land stations.. . . .	50
Ship stations.. . . .	200
	<hr/>
	441

Total.. . . .	<hr/>	579
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The total number of stations in operation in the Dominion of Canada and of the ships registered therein on March 31, 1922, was as follows:—

COAST STATIONS—

East coast.. . . .	19
West coast.. . . .	9
Hudson bay.. . . .	1
Great Lakes.. . . .	8
	<hr/>
	37

GOVERNMENT LAND STATIONS.. . . .	1
----------------------------------	---

DIRECTION FINDING STATIONS—

North Atlantic	4
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LICENSED COMMERCIAL STATIONS—

Public commercial.. . . .	6
Private commercial.. . . .	20
	<hr/>
	26

LICENSED EXPERIMENTAL STATIONS—

Province of Ontario.. . . .	17
Province of Quebec.. . . .	7
Province of Prince Edward Island.. . . .	1
Province of Nova Scotia.. . . .	3
Province of Alberta.. . . .	1
Province of British Columbia.. . . .	5
Province of New Brunswick.. . . .	1
	<hr/>
	35

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LICENSED TRAINING SCHOOLS—

Province of Ontario..	7	
Province of Quebec..	7	
Province of Prince Edward Island..	2	
Province of Nova Scotia	1	
Province of British Columbia..	5	
Province of Saskatchewan..	1	
Province of Manitoba..	2	
	<hr/>	25

AMATEUR RADIOTELEGRAPH STATIONS—

Province of Ontario—		
Toronto..	213	
Other localities..	422	
	<hr/>	635
Province of Quebec—		
Montreal	138	
Other localities..	59	
	<hr/>	197
Province of New Brunswick—		
St. John..	17	
Other localities..	3	
	<hr/>	20
Province of Nova Scotia—		
Halifax..	8	
Other localities..	37	
	<hr/>	45
Province of Prince Edward Island..		17
Province of Manitoba—		
Winnipeg..	61	
Other localities..	10	
	<hr/>	71
Province of Saskatchewan..		42
Province of Alberta..		24
Province of British Columbia—		
Vancouver..	88	
Victoria..	45	
Other localities..	39	
	<hr/>	172
Yukon and Northwest Territories..		3
		<hr/>
Number of Amateur stations in Canada..		1,226

LICENSED SHIP STATIONS—

Province of Ontario..	62	
Province of Quebec..	107	
Province of New Brunswick..	2	
Province of Nova Scotia	6	
Province of Prince Edward Island..	1	
Province of British Columbia..	49	
Total..	<hr/>	227

The following Government steamers are equipped with radiotelegraph installations operated by the Department of the Naval Service:—

Name	Range	Call Signal
Acadia..	200 miles	VDT
Arloux..	150 "	CFL
Amontec..	150 "	CFM
Arras..	150 "	CFO
Givenchy..	150 "	CFN
Gulnarc..	150 "	VBZ
Malaspina..	200 "	VDU
Stadacona..	200 "	VBV
Submarine H.14..	GCLK
Submarine H.15..	GCBE
Thiepvat..	150 miles	CFP

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OPERATED BY THE DEPARTMENT OF MARINE AND FISHERIES

Name	Range	Call Signal
C.G.S. <i>Laurentian</i>	150 miles	CFC
" <i>Stanley</i>	150 "	VDE
" <i>Lady Laurier</i>	150 "	VDF
" <i>Abaddon</i>	100 "	VDG
" <i>Druid</i>	100 "	VDH
" <i>Montcalm</i>	150 "	VDJ
" <i>Lady Grey</i>	100 "	VDL
" <i>Esteron</i>	200 "	VDN
" <i>Dollard</i>	150 "	VDO
" <i>Newington</i>	100 "	VDP
" <i>Lurcher Lightship</i>	100 "	VDR
" <i>Adammore</i>	200 "	VDQ
" <i>Bellechasse</i>	100 "	VDS

OPERATED BY THE DEPARTMENT OF RAILWAYS AND CANALS

<i>Sheba</i>	200 miles	VDZ
<i>Thomas J. Drummond</i>	200 "	CHY
<i>J. A. McKee</i>	200 "	CHX

OPERATED BY THE CUSTOMS DEPARTMENT

<i>Margaret</i>	200 miles	VDW
<i>Restless</i>	150 "	VGJF

OPERATED BY THE PUBLIC WORKS DEPARTMENT

<i>Tyrian</i>	150 miles	VDK
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LICENSED LIMITED COAST STATIONS

The total number of stations in operation in Canada on March 31, 1922, was 1,612.

OPERATION OF THE COAST STATION SERVICES

The total number of messages and words handled during the year were as follows:—

	Messages	Words
East Coast	155,839	2,758,297
Great Lakes	22,692	347,223
West Coast	148,561	2,339,500
Hudson Bay	Nil	Nil
	327,092	5,445,020

The amount of business handled by the East Coast system shows a decrease from last year's business amounting to 49,574 messages, containing 1,008,566 words.

The Great Lakes system (operated by the Marconi Wireless Telegraph Company of Canada under contract) shows a decrease of 1,647 messages with a decrease of 51,011 words.

The West Coast system (operated directly by this Department) shows a decrease of 36,630 messages containing a decrease of 729,616 words.

The Hudson Bay system was not in operation during the year.

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Table No. 1 shows a comparative statement of the business handled by the different systems during the past twelve years.

TABLE No. 1. COMPARATIVE STATEMENT OF BUSINESS HANDLED BY THE RADIO TELEGRAPH SYSTEMS DURING THE PAST TWELVE YEARS

Service	1910-11		1911-12		1912-13	
	Messages	Words	Messages	Words	Messages	Words
East Coast	71,594	1,179,434	119,049	1,824,450	153,843	2,704,411
Great Lakes.....	Nil		1,043	17,095	2,750	52,422
West Coast	48,074	647,461	76,158	997,900	115,494	1,518,926
Hudson Bay						
	119,668	1,826,895	196,250	2,839,445	272,087	4,275,759
	1913-14		1914-15		1915-16	
	Messages	Words	Messages	Words	Messages	Words
East Coast	145,605	2,443,145	59,846	1,196,512	45,195	864,020
Great Lakes...	9,601	219,786	15,785	326,505	13,617	259,366
West Coast,	157,354	2,206,331	98,386	1,532,526	95,048	1,103,395
Hudson Bay			5,259	325,961	7,617	570,281
	312,560	4,869,262	179,276	3,381,504	161,477	2,797,062
	1916-17		1917-18		1918-19	
	Messages	Words	Messages	Words	Messages	Words
East Coast	37,835	704,469	36,771	820,230	70,179	1,565,698
Great Lakes	16,521	311,800	16,809	307,729	19,130	402,937
West Coast	121,120	1,732,420	147,885	2,308,261	187,668	3,624,160
Hudson Bay	6,264	392,154	5,934	430,080	3,004	212,036
	181,740	3,140,843	207,399	3,866,300	279,981	5,805,771
	1919-20		1920-21		1921-22	
	Messages	Words	Messages	Words	Messages	Words
East Coast	147,208	2,860,821	205,413	3,766,863	155,839	2,758,297
Great Lakes	20,157	370,021	24,339	398,234	22,692	347,223
West Coast,	173,968	2,898,148	185,191	3,069,116	148,561	2,339,500
Hudson Bay	Nil	Nil	Nil	Nil	Nil	Nil
	341,333	6,128,990	414,943	7,234,213		

COMPARISON WITH 1920-21 DECREASE

Messages	Words
49,574	1,008,566
1,647	51,011
36,630	729,616
Nil	Nil

*The Port Nelson and Le Pas stations were not in operation during the past year.

REVENUE FROM TRAFFIC

The total amount of revenue collected during the year amounted to \$54,161.76, as against \$64,978.61 in 1920-21.

The West Coast service shows a decrease of \$13,404.51, the Great Lakes an increase of \$0.08, and the East Coast an increase of \$2,587.58.

Table No. 2 shows a comparative statement of the revenue collected by the Coast Station services during the past thirteen years:—

TABLE No. 2

	1909-10	1910-11	1911-12	1912-13	1913-14
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
East Coast	Nil	Nil	229 57	475 00	318 42
Great Lakes.	Nil	Nil	Nil	17 08	27 55
West Coast.	Nil	3,108 63	4,484 77	9,928 40	15,992 70
Totals.	Nil	3,108 63	4,714 34	10,420 48	16,338 67
	1914-15	1915-16	1916-17	1917-18	
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	
East Coast.....	322 99	1,022 33	987 67	981 90	
Great Lakes.....	85 92	78 16	107 90	103 20	
West Coast.....	11,329 44	7,394 60	15,635 76	21,333 18	
Totals.....	11,738 35	8,494 99	16,731 33	22,418 28	
	1918-19	1919-20	1920-21	1921-22	
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
East Coast	1,584 02	1,402 48	14,343 70	16,931 28	
Great Lakes...	70 66	113 18	164 47	164 55	
West Coast.....	42,634 09	49,949 02	50,470 44	37,065 93	
Totals.....	44,288 77	51,464 68	64,978 61	54,161 76	

EXAMINATION FOR CERTIFICATE OF PROFICIENCY IN RADIOTELEGRAPHY

Three hundred and twenty-nine operators were examined during the year including 158 re-examinations; 134 candidates were successful and 195 failed.

ASSISTANCE RENDERED TO SHIPS DURING THE YEAR BY GOVERNMENT RADIOTELEGRAPH SERVICE

West Coast

SS. West Hartland and Governor.—On April 1, 1921, the Gonzales Hill station received a distress message from the ss. *West Hartland*, when this vessel rammed the ss. *Governor* off Point Wilson in Puget sound. Distress call and particulars immediately relayed to Seattle (N.V.L.). Distress message from *Governor* “in collision, sinking fast, rush help,” broadcasted and particulars given to ss. *Adelaide* who altered course for Point Wilson. The *West Hartland* advised later that *Governor* sank and that the *Adelaide’s* assistance not required as this vessel was looking after survivors.

SS. Tokuyo Maru.—On May 2, 1921, the Triangle Island station received a distress message from the ss. *Tokuyo Maru* advising vessel on fire and sinking fast. As Triangle could raise no ships in vicinity information was given to the Estevan and Gonzales Hill stations, who broadcasted particulars. The information sent out by Estevan was picked up by the United States coastguard steamer *Snohomish*, who with the United States army transport *Buford* went to the assistance of the *Tokuyo Maru*. The *Buford* picked up all but four or five of passengers and crew.

SS. Chelohsin.—On August 12, 1921, the Bull Harbour station received a distress message from the ss. *Chelohsin* advising touched rock off Table island. Later reported leak in forehold but pumps able cope with it.

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SS. Princess Ena.—On August 14, 1921, the Bull Harbour station received a distress message from the ss. *Princess Ena* advising ashore Cormorant island.

SS. Canadian Importer.—The ss. *Canadian Importer* sprung a leak somewhere off the Pacific coast and was missing for a long period. No distress signals were heard. The W T equipment was rendered useless due to the engines being flooded and ship's dynamo under water. On August 25, 1921, the Gonzales Hill station was advised by the United States station at North Head to request all ships to look out for a whale boat belonging to the ss. *Canadian Importer*. This information was telephoned to the Victoria "Colonist" immediately. The *Importer* was eventually located and towed into Victoria, B.C.

Givenchy.—On September 3, 1921, the ss. *Givenchy* reported to the Bull Harbour station as being on a rock in Raven cove, Chatfield island, not making water, crew ashore. The steamers *Camosun*, *Princess Alice* and *Venture* were requested to look out for the *Givenchy* when passing. The crew were taken on board the *Princess Alice*.

Bark Tolmie.—On December 1, 1921, the Gonzales Hill station received advice from the United States Coast station at Seattle that the bark *Tolmie* was disabled three miles from Neah bay, steering gear broken. The Canadian National Railway was immediately advised by telephone, with result that salvage steamer *Alarinc* was despatched to pick up disabled vessel and tow to Esquimalt. The *Tolmie* was not equipped with wireless.

SS. San Antonio.—On December 2, 1921, the ss. *San Antonio* sent a message through the Point Grey station to the Kingsley Navigation Company, advising ashore at Roche point and requesting assistance of tug. Vessel finally floated on December 3.

SS. Canadian Rover.—On December 5, 1921, the Cape Lazo station received a distress message from the ss. *Canadian Rover* advising struck Sand bottom off Campbell river. Assistance was offered by United States revenue cutter *Snohomish* but declined. The *Rover* floated on December 6 and proceeded north.

Air Board Seaplane.—On December 13 the Point Grey station received advice by telephone from the Air station that word had been received via a pigeon carrier that their seaplane was in difficulties near the lightship off Fraser river. The plane had made a landing but was unable to rise owing to heavy sea and needed assistance. A broadcast message was sent out asking any vessel in vicinity to render assistance. The ss. *Lewis Luckenback* passing abeam of Point Grey advised would proceed in direction of lightship. The *Luckenback* after reaching a point three-quarters of a mile west of lightship stated could see nothing of sea plane. The Air station advised later that tugs were alongside the plane and no further assistance necessary. This information was broadcasted and thanks expressed to the master of the *Luckenback* for trouble taken.

C.P.R. Transfer Barge No. 8.—On December 18, 1921, the Gonzales Hill station received advice from the American steamer *San Antonio* that the Canadian Pacific Railway transfer barge No. 8 was ashore south of Portier Pass (between Nanaimo and Vancouver). The marine superintendent of the B.C.C.S. was advised by telephone. The *Algerine* was dispatched to assistance and succeeded in floating the barge. The *Transfer Barge* was not equipped with wireless.

SS. Canadian Observer.—On January 12, 1922, the Cape Lazo station received a message from the ss. *Canadian Observer* addressed to the vessel's Vancouver agent, advising ashore and bottom in Deep bay, Discovery passage. Cape Lazo stood by until *Observer* floated.

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Shipping generally.—An arrangement has been made with the Point Grey and Gonzales Hill for ships to report positions to those stations. Ships off Prospect point (one hour from Vancouver) report to Point Grey, Point Grey advises the Merchants exchange, Vancouver, they in turn advise interested parties; after 5 p.m. the Harbour master is advised. Ships leaving outer docks, Victoria or Quarantine, report the time to Gonzales Hill, that station advises Point Grey for further distribution. The above procedure has been of considerable value to the shipping fraternity and has been the subject of congratulation to the department.

East Coast and Great Lakes

SS. Mullen.—On April 14, 1921, the Sault Ste Marie station established communication with the ss. *Mullen* ashore on Whitefish point. A tug and lighter were sent out from Sault Ste Marie.

SS. John Reiss.—On May 15, 1921, the Point Edward station was in communication with ss. *John Reiss* ashore on east side of entrance to St. Clair river, in fog. Communication maintained.

SS. Zillah.—On May 14, 1921, the Sault Ste Marie station received a report from the ss. *Zillah* advising two barges lost in vicinity Whitefish point; all vessels in vicinity were fully advised. Steamer *Renown* advised Sault Ste Marie of wreckage observed consisting of spar and cabin with one man clinging thereto, location three miles north of Whitefish point. *Renown* rounded to but before getting alongside man washed off.

SS. Beaverton.—On August 15, 1921, the Toronto station reported the ss. *Beaverton* ashore Sister light, below Alexandria bay, bottom torn in forward tank and fore peak. Lighters and pumps sent for.

SS. Sarnian.—On August 29, 1921, the Toronto station reported the ss. *Sarnian* aground on Espanole island. Vessel refloated on August 31.

SS. Lewiston.—On September 26, 1921, the Sault Ste Marie station was advised by the ss. *J. L. Reiss* that the ss. *Lewiston* was aground below Little Rapid cut. A tug was sent to the assistance of this vessel.

SS. Anna C. Minch.—On October 18, 1921, the Sault Ste Marie station reported the ss. *Anna C. Minch* ashore on bar, north east end Bois Blanc. Tugs and lighters sent to assistance from St. Ignace and Sault Ste Marie. The *Minch* was refloated on October 19, leaking slightly.

SS. Home Smith.—On November 17, 1921, the Point Edward station reported the ss. *Home Smith* aground in the middle of lake St. Clair, no damage. Vessel refloated on November 18.

SS. Karl Bradley.—On November 19, 1921, the Point Edward station received a report from the ss. *Karl Bradley* advising has struck submerged obstruction in the down-bound channel of lake St. Clair, about 1,000 feet from south west end. The ss. *Stack* was notified.

SS. Riverton.—On November 28, 1921, the Point Edward station received a report from the ss. *Riverton* concerning an obstruction mostly submerged half mile above Lake Huron lightship, almost on the ranges.

SS. Phillip Minch.—On December 1, 1921, the Sault Ste Marie station received a report from the ss. *Phillip Minch* ashore about eight miles east of Detour in the vicinity of the Estanore island, Tug *Favourite* standing by. Vessel reloaded cargo at Detour on December 5.

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SS. Impoco.—On April 5, 1921, the Cape Sable Island was in communication with the ss. *Impoco* ashore on Blond rock.

SS. Lord Antrim.—On July 3, 1921, the North Sydney Station reported the ss. *Lord Antrim* ashore in Bay St. Lawrence, no damage feared. Vessel refloated on 4th and proceeded North Sydney.

SS. Chattanooga.—On July 3, 1921, the Cape Race station received a report from ss. *Chattanooga* advising boilers disabled position 42.25 N. 43.46 W.

SS. Seirstad.—On July 20, 1921, the Cape Race station reported the ss. *Seirstad* struck iceberg 48.57 N. 49.00 W. Bow damaged above water but vessel not leaking.

SS. Canadian Recruit and SS. Maskinongé.—On August 18, 1921, the Grosse Isle reported the steamers *Maskinongé* and *Canadian Recruit* in collision, heavy fog and advised all vessels in vicinity that later vessel in sinking condition. On the 19th August the ss. *Corinaldo* notified Grosse Isle all vessels in vicinity that a vessel had sunk off South bank abreast channel patch and was a danger to navigation.

SS. City of Brunswick.—On August 26, 1921, the Camperdown station received a distress message from the ss. *City of Brunswick* advising struck "The Sisters" near Sambro. Tugs were sent from Halifax to the assistance of this vessel.

SS. Karenrogeheas.—On October 1, 1921, the Point Riche station reported the ss. *Karenrogeheas* grounded on Ferolle point in a dangerous position and making water. Ships sent to her assistance. Later vessel reported half full of water. Point Riche unable to raise her by W T steamer *Linden Hall* turned back from proceeding to assistance. On October 2 ss. *Orithia* reported had passed Ferolle point at 6 p.m. October 1, but no sign of *Karenrogeheas*.

SS. San Francisco.—On November 13, 1921, the Cape Race station received a distress message from the ss. *San Francisco* advising on fire but no immediate danger, ss. *Hamon de Larrinaga* standing by.

SS. Tonesit.—On December 9 the ss. *Tonesit* reported to the Cape Race station, reduction gear broken assistance asked for. Vessel drifting eastward in a westerly gale.

DIRECTION FINDING STATIONS—EAST COAST

The Direction Finding Stations continue to render valuable assistance to navigators. The following is a summary of bearings given to ships by the four stations on the East coast during the fiscal year ending March 31, 1922.

Station	Single Bearings	Cross Bearings		Total
		Two Stations	Three Stations	
Chebucto Head	958	646	6	1,610
Canso	773	445	53	1,271
Cape Race	2,800	169	21	2,990
St. John	588	0	2	590
Totals	5,119	1,260	82	6,461

Above figures compiled from returns sent in monthly to Headquarters.

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ASSISTANCE RENDERED TO SHIPS DURING THE YEAR BY GOVERNMENT DIRECTION FINDING STATIONS

SS. Ozette.—On June 20, 1921, the Chebucto Head D/F station received a report from the U.S.C.G.S. *Sawyer* that the *ss. Ozette* with boiler break down requires tow to Halifax. Bearing from Chebucto 180 degrees. Navy advised. Tug *Musquash* went to assistance and towed the *Ozette* to Halifax.

SS. Western Hero.—On December 13, 1921, the Cape Race station reported the *ss. Western Hero* in distress short of fuel; assistance required.

SS. Mod.—On January 21, 1922, the Cape Race station reported the *ss. Mod* sinking *ss. George Washington* proceeding to assistance. On January 22 the Cape Race reported *ss. Mod* sank; 25 survivors out of crew totalling 33 rescued and on board *Melmore Head*. All ships in vicinity searching for missing boat.

SS. Grontoft.—On March 2, 1922, the Cape Race station reported the *ss. Grontoft* sinking, *ss. Estonia* proceeding to her assistance.

SS. City of Brunswick.—On August 26, 1921, the Chebucto Head D/F station intercepted messages from the *ss. City of Brunswick* asking for assistance, ship on rocks. Bearing 183½ degrees given to ship and navyard advised by landline. Bearing given later places ship in line with Sisters rock near Sambro island. *City of Brunswick* pounding badly requests tugs. Tugs from Halifax and life-boat from Duncan's Cove proceeded to assistance, crew taken off. Attempt to float vessel unsuccessful; ship total wreck.

SS. Baleine.—On September 30, 1921, the Chebucto Head D/F station received advice from the Canso D F station that the *ss. Baleine* struck Cape Hog, water gaining rapidly, proceeding Sand Point beach ship Navyard advised. Vessel abandoned when off Sand point.

SS. Royal.—On October 13, 1921, Cape Race reported the *ss. Royal* ashore at Chance cove, near Cape Race. Bearing from Cape Race 222 degrees being the reciprocal of the actual bearing, Navyard advised.

SS. Gilda.—On December 12, 1921, the Chebucto Head D/F station received a distress message from the *ss. Gilda* broken down in latitude 39.30, longitude 49.10 west requires assistance. Navyard advised.

SS. New England.—On December 22, 1921, the Chebucto Head D F station broadcasted the following message: "All vessels vicinity of Halifax and Cape Sable, *ss. New England* at 0630 GMT; bearing 107½ degrees distance about 30 miles off Chebucto Head drifting and without fuel oil N.W. gale, request immediate assistance." In connection with the rescue of this vessel Chebucto assisted the C.G.S. *Lady Laurier* to make harbour in a very thick snow storm by numerous D/F bearings.

SS. Storm King.—On December 26, 1921, the Chebucto Head station received a report from the *ss. Storm King* advising disabled. *Ss. Balsam* going to assistance. Bearing from Chebucto 159½ degrees from Canso 193 approximately. Navyard advised. Bearings given to both vessels.

SS. Holtby.—On May 18, 1921, the Canso D F station intercepted a call sent out by the *ss. Holtby* asking for name of steamer which has collided with her. Steamer afterwards found to be *ss. Lady of Gaspe*. Bearing of *Holtby* from Canso 88 degrees. Canso gave several bearings to *Holtby* subsequently and advised Navyard by landline.

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SS. Baleine.—On September 30, 1921, the Canso D/F station received a distress message from the trawler *Baleine* advising struck cape Hogan, straits of Canso, proceeding towards Sand point to beach ship, making water fast. Advise broadcasted on 600 and 800 metres and bearing given to ship on request. When subsequently beached a short distance from cape Argos bearing 306 degrees true. Advised Navyard by landline.

SS. Thyra.—On February 5, 1922, the Canso D/F station received a message from the Norwegian steamer *Thyra* via Sable island asking for bearing on 600 metres, ship not being fitted for 800 metres. Ship in distress, rudderless, endeavouring make Halifax. Bearing given to *Thyra* 158½ degrees from Canso. Co-operated with Chebucto Head in cross bearing. Canso gave three bearings to C.G.S. *Lady Laurier* who proceeded to assistance. Canso gave subsequent cross bearings to *Lady Laurier* while towing *Thyra* to Halifax.

SS. Seapool.—On June 8, 1921, Cape Race D/F station received advice from *ss. Seapool* struck iceberg latitude 47.50 N. longitude 48.30 W. Bearing given with difficulty. This vessel made port of St. Johns, Newfoundland.

SS. Charlot.—On June 9, 1921, the Cape Race D F station received report from *ss. Charlot* advising struck iceberg, position latitude 51 N., longitude 48.30 W. After several bearings given *Charlot* corrected position to 49.31 N., 50.30 W. Other bearings given. Ship made port of St. Johns, Newfoundland.

NEW CONSTRUCTION, ADDITIONS AND ALTERATIONS

WEST COAST

Dead Tree Point.—The mast was overhauled.

Point Grey.—The masts were overhauled, painted and repairs made to verandah of operating house. An addition to the operating house was made to accommodate toilet and washbasin. A septic tank was built and all sanitary arrangements connected to same. The buildings were painted and grounds cleared of undergrowth.

Cape Lazo.—The three stick mast was taken down, aerial readjusted, battery room built in engine room and small repairs made to dwelling-house.

Gonzales Hill.—A new receiving aerial was put up in connection with the "Break system." A wave-changing switch and tungar rectifier for charging filament batteries were installed.

Alert Bay.—The masts were overhauled and painted and guys reinsulated, air equipment overhauled, auxiliary 2 K.W. set installed to run off 10 horse-power engine, track overhauled

Digby Island.—The operating house and masts were painted and guys and receiving equipment overhauled. A seven-step amplifier and charging equipment were installed. A power line to connect with power cables was built. During February, 1922, tests were conducted with a vessel operating in the Portland canal in order to obtain information with regard to the possibility of a station being erected at Stewart, B.C. Tests were carried out for the purpose of establishing direct working with Point Grey.

Triangle Island.—This station was closed in June, 1921, and substituted by the Bull Harbour station. As the latter station immediately continued the work of Triangle there was no delay due to change.

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Bull Harbour.—The new station at Bull Harbour was placed in commission on June 25, 1921. The completed establishment consists of a large operating house, two standard bungalows for the accommodation of married members of staff and single operators. All buildings have been equipped with plumbing and sanitary conveniences, water being supplied under pressure from an elevated tank of 1,000 gallons capacity which is filled by a gasoline engine driven pump taking its supply from a well on the site. The station is equipped with a 2 K.W. transmitter driven from 6-horse power engine. The receiving equipment consists of up-to-date apparatus, including valve amplifier, etc., together with necessary generating equipment for charging receiver storage batteries. An efficient listening-through system has been installed. Very satisfactory communication has been established between Bull Harbour and ships passing through the whole length of Johnston strait and Discovery passage and also between Bull Harbour and Vancouver, Prince Rupert, Estevan, Alert Bay, and all the private commercial stations in this region. Provision has been made in the operating house building to accommodate a large storage battery from which the station may be more efficiently operated when traffic warrants its installation.

Estevan Point.—The new construction work was practically completed. This work included clearing of heavy timber from site, repairs to light railway track, improvement of haulage facilities from landing, erection of a new power house and installation therein of a 50 horse-power engine driven generating set and 1,600 ampere hour 120 volt storage battery, installation of a more powerful transmitter in operating house, rearrangement of old transmitter, erection of new transmitting aerials and erection of new receiving aerials to minimize interference. Establishment of efficient listening through system. Erection of one new bungalow for married quarters. Installation of general drainage system and sanitary conveniences. Operation of station on storage battery was commenced on March 27, 1922, with excellent results.

Lulu Island.—Tests covering a period of two weeks were made the results of which were eminently satisfactory. This temporary station was closed on October 25, 1921.

General.—During the month of January, 1922, reception tests were arranged and conducted from a vessel transmitting in Seymour narrows, records of the tests being submitted by all the stations within range.

EAST COAST

Barrington Passage, N.S.—The towers were scraped and repainted and a thorough overhaul given to all outside gear. Further work on the inside of the Army Barracks was done to give increased accommodation to married operators.

St. John, N.B. D/F.—On July 1, 1921, the Partridge Island station was closed down and the St. John D/F station took over the whole of its commercial work.

The arrangements whereby a ship calls the D/F station on the standard wavelength of 600 metres for its commercial work and resorts to 800 metres for D F work has proved entirely satisfactory. An electric supply service from the city of St. John to the station at Red Head has been completed. Suitable W T power apparatus and auxiliary manipulating gear for quick change of wavelengths were installed. Improvements were made in fencing, sewage, plumbing and electric water pressure system. A separate receiver with valve detector and amplifiers were installed for commercial work only eliminating undue wear on D F instruments. A type 55 F amplifier with saturation device was fitted to the D, F receiver which obtained increased receiving range and decided minima of tuning resulting in increase of accuracy of bearing-given. The station was recalibrated for deviation error and slight changes in the correction factors where necessary were made.

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Chebucto Head, N.S., D/F, Canso, N. S., D/F, Cape Race, Nfld., D/F.—Type 55 F amplifiers with saturation devices were fitted to each D/F receiver which obtained increased receiving range and decided minima of tuning resulting in increase of accuracy of bearings given. The stations were recalibrated for deviation error and slight changes in the correction factors where necessary were made.

Montreal, P.Q.—The location of the station at Tarte Pier, Montreal, had long been considered an unfavourable one from a receiving point of view. Induction from the high tension power lines in the vicinity had become so intense that in 1914 it was decided to remove to a new site. Accordingly land was purchased for this purpose in St. Michel de Laval. Owing to pressure of other work during the war the removal to the new site was not carried out. Work however was started on August 1, 1921, on the erection of a new operating house on the new site. A three piece mast with umbrella type aerial was also erected. The old station was officially closed and the new one placed in commission on October 10, 1921.

GREAT LAKES

Port Burwell, Ont.—For a number of years erosion of some few miles of the lake Erie shore in the vicinity of the Port Burwell station had progressed to such an extent as to imperil the safety of the station. In February, 1921, it was decided to move the buildings and masts to a new location about 700 feet further inland and a site of three acres was expropriated at this point. Only one mast was re-erected at the new site using the umbrella type of aerial. The station was recommissioned on May 4, 1921.

6. STORES BRANCH

Under the original organization, the Stores Branch at Headquarters was divided into three divisions, namely, the Purchasing and Contract Division, the Stores Division, and the Stationery and Printing Division. There were also the Stores Depots at H.M.C. Dockyards, Halifax, N.S., and Esquimalt, B.C. Shortly after the outbreak of the war, the Transportation Division was organized, owing to the necessity of utilizing all available tonnage for overseas shipment. To cope with the traffic, the department undertook to supply empty Admiralty colliers with the cargoes for European ports. A very thorough organization was evolved in conjunction with Mr. A. H. Harris, Acting Director Overseas Transport, whereby thousands of tons of material daily from all parts of Canada were shipped to allied nations. The Transportation Division has since been discontinued. During the past year the Naval Armament Supply Division has been organized at Headquarters, as well as Armament Supply Depots at each Dockyard. During the war also, owing to the inauguration of an anti-submarine campaign on the Atlantic coast towards the end of the year 1917, which involved the commissioning of a large number of patrol vessels, trawlers, drifters and other craft, Auxiliary Supply Depots at different points were organized to take care of the peculiar requirements of these small craft. On the cessation of hostilities, these depots and services were discontinued.

PURCHASING AND CONTRACT DIVISION

The work of this division has to do with the execution and supervision of all contracts and purchases, including also the chartering of vessels, the making of contracts for the erection of buildings and other permanent structures, for water supplies, electric light and power, telephone services, etc., for the victualling of

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ships' crews where the victualling is not done by the department, the purchase, by contract or otherwise, of all necessary stores and supplies of every description, and the sale of stores and ships surplus to the requirements of the department.

In addition to the Naval Service proper, the following services are served in this way: Hydrographic Surveys, Tidal and Current Surveys, Radiotelegraph Service, and the Fisheries Protection Service. From 1914 to 1920, similar service was also rendered to the Life Saving Service, Fishery Patrol Service, Fish Breeding Service, as well as other fishery Services throughout the Dominion.

To the utmost extent possible, all Services attached to the Department utilize the storekeeping facilities available at the Dockyards at Halifax and Esquimalt, drawing supplies from these points. Therefore, the main duty of this division is the procuring of supplies to replenish stocks carried at the Dockyards. Annual forecasts of requirements are prepared by each Dockyard at the commencement of the year, in which provision is made for the requirements of the ensuing year. Unforeseen requirements arising during the course of the year are requisitioned from time to time as necessary.

Supplies purchased include a very wide range under the following six general categories:—

- (a) Provisions;
- (b) Clothing and Clothing Materials;
- (c) Medical Supplies;
- (d) Naval Stores, including lumber, metal and hardware, tools, textile and cordage, packings and rubber goods, paints and oils, leather goods, glass furnishings, brushes, etc., electrical supplies, wireless equipment and fuel;
- (e) Armament Stores, including ordnance, ammunition and torpedo stores, and
- (f) Stationery and Printing.

Considerable purchases have also been made on behalf of the Imperial Government and to a lesser extent on behalf of other Governments. During the war especially, very large quantities of provisions and other staple commodities were purchased for shipment to England and to H.M. Victualling Yards abroad.

In effecting purchases from Headquarters, tenders are called for in practically every instance. All known manufacturers, wholesale establishments and other dealers are invited to tender, thus affording the trade the fullest opportunity to secure the business and at the same time, obtaining supplies to the best possible advantage. Although the bulk of requirements are purchased direct from Headquarters at Ottawa, a considerable portion of the purchases are effected locally. In all instances the same procedure governs and the whole is supervised by Headquarters. Detailed specifications form an integral part of the purchasing system and are used for the great majority of items purchased. These specifications, while based essentially on Imperial naval experience, have nevertheless been revised as far as possible to meet conditions obtaining in the Canadian trade. This work of revision is always on hand and good progress has been made during the past year.

Contracts are maintained on both coasts for supplies of fresh provisions, coal, ice, etc., for the convenience of ships operating in adjacent waters. These are made applicable to, and are taken advantage of, by the ships of the Imperial, as well as during the war by ships of Allied Governments.

During the year the total value of all purchases made amounted to \$1,050,309.92. The following is a summary thereof under the different classifications enumerated:—

Provisions..	\$203,622 09
Clothing..	13,057 00
Medical Stores..	944 00
Coal and Oil Fuel..	474,391 84
Naval and Miscellaneous Stores..	200,813 24
Armament Stores..	36,061 00
Stationery and Printing..	121,420 75

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Efforts to effect sale of the remaining vessels in the possession of the department as well as Admiralty vessels remaining on our hands were continued during the year. As a result the department succeeded in disposing of the *Vigilant* and drifter No. 6. Negotiations also were carried on which finally resulted in the resale of the *Niobe* and the *Shearwater*. The activities of the branch in connection with the sale of surplus vessels and craft are of considerable interest. During the latter months of the war the department had in commission approximately 200 ships and vessels of various sorts. Of these 60 trawlers and 86 drifters belonged to the Admiralty who requested that they be offered for sale. Endeavours in this direction resulted in the sale of 14 trawlers and 36 drifters, the remainder being taken to Great Britain for sale in that country. The sum realized from these sales amounted to \$928,120 in the case of the trawlers and \$333,466 in the case of the drifters. In addition, 30 vessels owned by the department, including the cruisers *Niobe* and *Rainbow* and the submarines C.C.L. C.C. 2 were disposed of, the sum realized being \$640,439. Eighteen motor-boats and other small craft were also disposed of, the amount realized being \$11,276.

During the war large reserves of supplies of every kind were maintained to meet the requirements of our own vessels. In addition, in November, 1917, the Admiralty issued instructions that armed merchant cruisers calling at Canadian and American ports should obtain all of their supplies of provisions at such ports, and furthermore that they should demand quantities in excess of their requirements for landing in England, and asked the department to co-operate with them in this regard by making available the supplies required. Immediately following the cessation of hostilities the demand for these supplies ceased abruptly and this, together with the demobilization of the Canadian fleet, left the department with large surpluses for which there was no outlet. Immediate action was taken for the disposal of surplus stores by inviting tenders by public advertisement, and also by arranging with other Government departments to utilize these surpluses to meet their requirements. Notwithstanding the fact that commercial conditions were decidedly unfavourable for the sale of these stores, and that the market in practically all commodities was a declining one, the department succeeded in effecting disposal of stores aggregating in value \$777,385.64. The stores sold included staple provisions, clothing and materials, cordage, lumber, wire rope, packings, etc.

STORES DIVISION AND SUPPLY DEPOTS AT THE DOCKYARDS

The functions of the Stores Division are the supervision and control of all matters pertaining to the provision, receipt, care, repair, issue, accounting and audit of all stores, other than armament stores, for all ships and establishments, including the victualling of ships where the victualling is done by the department. Though organized primarily for the purpose of supplying all men-of-war and other naval establishments with all stores and other necessary equipment, the branch has always extended equal facilities to vessels of the Fisheries Protection Service and of the Hydrographic Survey, to the Radiotelegraph Service and the Tidal and Current Surveys. From 1914 to 1920, service was also rendered to the Life Saving Service, to vessels of the Fisheries Patrol Service and to fish hatcheries and other fisheries establishments throughout the Dominion. Considerable difficulty was experienced in the supplying of these services, owing to the disparity between the services themselves and the nature of the requirements. The policy of standardizing their requirements as far as possible was adopted with the result that considerable progress was made in this direction with gratifying results.

The principal aim of the branch whether in time of war or in peace time, is, however, to supply and equip men-of-war with every possible expedition and to render the maximum assistance possible for their efficient maintenance. This having been the main and all important function during the war, ships of the British Admiralty and of Allied Governments, as well as of the Canadian Naval Service, received first considera-

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tion. It is gratifying to report that the extension of facilities afforded the Imperial Service and the value of supplies issued to their ships and establishments brought about a closer relationship between the department and the British Admiralty. During the war the scope of this work was greatly extended since in addition to vessels of the Canadian Naval Service and auxiliary services, the number of which was largely increased, stores were supplied in large quantities to vessels of the Imperial Service and of Allied Governments. Immediately following the war and upon the demobilization of the naval forces, the branch was reduced to a peace basis.

During the year, supplies of stores were arranged for the vessels of the squadron, H.M.C. ships *Aurora*, *Patriot* and *Patrician* and the submarines *C.H. 14* and *C.H. 15*. The greatest possible economy was exercised in this by the transfer of stores between dockyards, where necessary, and by shipment to the West Indies when the ships were located in those waters. Besides these vessels, service has been rendered at Halifax to 56 and at Esquimalt to 29 ships and establishments, including small craft. Service was also rendered to 84 ships and establishments not connected with the department and including ships of the Imperial Service. Supply depots are maintained at both Halifax and Esquimalt Dockyards. These are in charge of experienced store officers who supervise the work and who are responsible to Headquarters for the performance of the duties allotted to them. It is their duty to be prepared at all times to provide and issue supplies of whatever nature required to all ships and establishments under the jurisdiction of the department and to such others as may be approved by Headquarters, to make a strict and careful accounting of all such issues; and to see that all supplies purchased are in accordance with specifications and in other respects suitable for the Service. The variety of stores handled is necessarily very wide and includes staple provisions; uniforms and clothing of all kinds and clothing materials; medical supplies, surgical instruments and hospital equipment, lumber of all kinds; metal of all kinds and in every state of manufacture; hardware and tools; textiles and cordage; packings and rubber goods, paints, oils, glass, leather goods, brushes, furniture and furnishings, tackle, navigating instruments; charts and other miscellaneous supplies of every nature; electrical stores of a very wide range; and coal and oil fuel. In the inspection and selection of this wide range of stores expert knowledge and wide experience are essential. For ships of war particularly, excellence of quality and reliability are of most vital importance. To this end standardization of supplies and a rigid system of inspection constitute two important factors of the supplies organization.

The nature of the Service demands that substantial reserves must be maintained at each naval base and kept readily available at all times. In times of peace ships' requirements can be forecasted very accurately, their allowances being carefully regulated. Ordinarily, and within reason, these reserves are based upon six months' requirements for all purposes. Owing to the large reserves which were available at the end of the war, no increase was made to them during the year other than of oil fuel at Esquimalt. On the other hand, steps were taken to dispose of surplus quantities. With a view also to adjusting the valuation of the stocks from war prices to prices obtaining under present market conditions, a revaluation was effected. At the close of the year 1921-22, the reserve at Halifax totalled in value \$1,879,265.92 and at Esquimalt \$737,165.03.

The volume of business transacted in 1921-22 at both Dockyards is reflected in the following brief statistics:—

		Number of Transactions Involved
HALIFAX DOCKYARD—		
Value of Stores received..	\$149,250 46	2,018
Value of Stores returned..	134,512 76	1,503
Value of Stores issued..	693,784 21	10,299
ESQUIMALT DOCKYARD—		
Value of Stores received..	\$ 73,449 49	1,188
Value of Stores returned..	16,094 20	563
Value of Stores issued	343,611 19	4,942

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It is interesting to observe that the overhead costs at the Dockyards in connection with the supply of stores to all ships and other establishments for the year under review was 10.68 per cent in the case of Halifax and 10.08 per cent in the case of Esquimalt. Inasmuch as all costs of whatever nature incidental to the maintenance and operation of the supply bases are included, these percentages are considered very satisfactory.

The system of central storekeeping which was introduced in H.M.C.S. *Aurora* on her commissioning in December, 1920, has proven entirely satisfactory. Under this system the central store officer is substituted for no less than five storekeeping officers charged with the keeping of accounts under the old system. Instead of authorized allowances being laid down for each class of stores which may be drawn, the central store officer is authorized to supply the requirements of the various ships' departments up to the value of an authorized monetary allowance. These allowances were carefully worked out on the basis of the former store warrants and by eliminating all items which by experience were known to be unnecessary. The accounts for the first period having just been closed have not yet been audited. They, however, show a substantial economy to have been effected after the first year of operation under this system.

The audit of all stores accounts had been continued with satisfactory results. Not only the Dockyards but the ships and establishments connected with the department keep store accounts in which receipts and expenditures are fully recorded. It is one of the functions of the branch to control the consumption of all stores so long as their serviceability continues. Each officer responsible for the custody of expenditure of stores of whatever nature must therefore make a full accounting for them, reporting direct to Headquarters where the audit is carried out. In the case of the store accounts of the Dockyards and Armament Supply Depots, a system of concurrent audit at Headquarters was inaugurated a little over a year ago. The new method is giving very satisfactory results, serving not only as an audit but also affording Headquarters information on stores matters at all times as an integral part of the system of stores control.

The system of biennial stocktaking whereby the stocks at both Dockyards are completely reviewed in the course of two years has been continued and good progress made. The results of the stocktaking made are on the whole very gratifying and testify to the efficient manner in which the staffs concerned have performed their duties.

The system of general messing whereby the complements of vessels of the naval and auxiliary services are victualled by the department direct has been continued with very satisfactory results. This system was established in vessels of the Royal Canada Navy in 1910, where it has always proven satisfactory. It was extended to vessels of the Patrol Service and of the Fisheries Protection Service because of the unsatisfactory results which were obtained in the victualling these vessels by stewards who performed this service in consideration of a daily rate for each member of the ships complements. The essential features of the general messing system are direct control of the stewards, the supply of stores purchased by contract and a particular headquarters audit. The experiment has proven an entire success and a considerable saving in the cost of victualling ships of the department has been effected. During the past year the average cost of victualling was 62.5 cents per man per diem.

STATIONERY AND PRINTING DIVISIONS

This division is charged with all matters pertaining to the supply and handling of stationery, printing and books to the Headquarters' staffs and to ships and establishments of the department. Although the main stocks are kept in Ottawa, a Stationery Depot was established at Halifax in 1918, in order that issues might be made more expeditiously and also to save, to a large extent, transportation costs by express. The

work of this division has always been onerous and was especially so during the period of hostilities. During the past year the total expenditure for all stationery and printing service was \$121,420.75.

As in the case of the other divisions of the Stores Branch, service is rendered in addition to vessels and establishments of the Naval Service proper to the Hydrographic Surveys, the Tidal and Current Surveys, the Radio Telegraph Service and the Fisheries Protection Service.

ARMAMENT SUPPLY DIVISION AND DEPOTS

The functions of the Armament Supply Division are the supervision and control of all matters pertaining to the provision, receipt, care, repair, testing, examination, issue, accounting and audit, of all Armament Stores, i.e. ordnance and ordnance stores, ammunition, torpedoes and torpedo stores, in connection with ships and establishments of the Canadian Naval Service, as well as the Imperial Service at Halifax and Esquimalt. The Armament Supply Division as presently constituted has only been organized during the past year, prior to which time armament store work was mainly performed by the naval staff with the assistance of the stores staff wherever possible.

Armament Supply Depots are maintained at both Halifax and Esquimalt in charge of thoroughly experienced officers. All necessary facilities for the care and handling of guns, gun mountings, ammunition, torpedoes and torpedo stores exist at both points. In the case of Halifax, the magazines in use at George Island and Fort Clarence are somewhat old and were originally gun batteries. All precautions are, however, taken to ensure the safety of these magazines. To this end, besides the compliance with magazine regulations in all essential respects, electric pumps have been installed for fire protection, lighting arrangements renewed and tracks relayed. Workshops for the testing, repair, etc., of torpedoes and paravanes and for the repair and upkeep of gun mountings and alterations to spare parts, etc., are provided. In the case of Esquimalt the magazines are located at Code Island and although old are in good repair and in every way safe. Facilities also exist for the repair and maintenance of armament stores generally.

In 1920 an agreement was made with the British Admiralty for the amalgamation of both Imperial and Canadian stocks of armament stores at Halifax and Esquimalt. Under this arrangement the Admiralty maintain at these points complete reserves for the Canadian Service in addition to the requirements of the Imperial Service. Considerable advantage is derived thereby, since a large portion of these reserves are of an explosive nature, and are therefore continuously and unavoidably deteriorating, sometimes very rapidly, and liable to become a total loss at any time when the prescribed tests denote that destruction is necessary in the public interest. A handbook of instructions for Naval Armament Supply Depots at H.M.C. Canadian Dockyards has been issued. Under the agreement with the Admiralty, it is provided that Imperial procedure and forms shall obtain. It was therefore necessary to draft regulations complying with this requirement in all essential respects, and at the same time having regard to Canadian conditions and requirements.

Besides the service rendered to ships and establishments of the Naval Service proper, both Canadian and Imperial, issues have been made to vessels of the Fisheries Protection Service and to vessels to other departments of the Government. As an indication of the scope of work of this branch, the following guns of various calibres were mounted in defensively armed merchant ships during the war by the department.

At Halifax, N.S.	223 in No.
Montreal, P.Q.	42 " "
Sydney, N.S.	1 " "
Quebec, P.Q.	3 " "
St. John, N.B.	2 " "
Esquimalt, B.C.	3 " "
Total.	274 " "

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In addition to mounting the above, thirty-five guns and mountings were despatched from Halifax for mounting in merchant ships at points outside Canada. Also, one hundred drifters and thirty-eight trawlers built in Canada for patrol and mine-sweeping duties were equipped with guns, mountings, rifles, pistols and ammunition. Considerable other work of similar nature and importance was carried out at different times.

The stocks of armament stores carried at Halifax and Esquimalt are necessarily large. In the following statement of values, the stores shown as Canadian represent almost altogether the free gift of armament stores made by the Imperial Government to the department with the squadron.

Value of Stores on March 31, 1922

At Halifax—	
Canadian stocks.. . . .	\$ 827,769 13
Imperial stocks.. . . .	705,665 70
Total.. . . .	<u>\$1,533,434 83</u>
At Esquimalt—	
Canadian stocks.. . . .	\$ 103,126 21
Imperial stocks.. . . .	143,809 80
Total.. . . .	<u>\$ 246,936 01</u>

In addition to these values must be added the value of the outfits of H.M.C. ships *Turcan*, *Patriot* and *Patrician*, estimated at \$400,000, \$55,000 and \$55,000 respectively, which were also a free gift from the Imperial Government.

In view of the generous equipment borne by H.M.C. ships and donated by the Imperial Government, the issues were considerably less than would have otherwise been the case. The following represent the values of receipts and issues of armament stores during the year:—

Receipts—	
At Halifax.. . . .	\$78,083 74
At Esquimalt.. . . .	2,190 63
Issues—	
At Halifax.. . . .	82,350 78
At Esquimalt.. . . .	12,457 38

As a consequence of the general disarmament of merchant ships and patrol vessels after the war, large quantities of ammunition were landed, with a view to minimizing the risks of keeping such large quantities of explosives which were not likely to be used up for practices within a reasonable time, and because in some instances of obsolescence, age or liability to deterioration, disposition of approximately 792 tons was made by destruction, by drowning, by return to England and Bermuda, as well as by transfer to the Department of Marine and Fisheries and the Department of Militia and Defence. The value of ammunition of which disposition has been made was approximately \$252,000. In addition 206 guns and mountings were dismounted from defensively armed merchant ships, drifters and trawlers and were returned to England. The value of these shipments alone was \$362,492 and their weight 315 tons.

Continuous stocktakings of Imperial and Canadian stocks are carried out at both depots. Reports of all discrepancies are forwarded to Headquarters every quarter, and in the case of Imperial stocks these are transmitted to the Admiralty. Satisfactory progress has been made in connection with these stocktakings and the results have shown great efficiency on the part of the staffs concerned.

The Armament store accounts of the depots as well as of ships and establishments have been kept and rendered in a satisfactory manner.

The staffs of the Armament Supply Depots, though working to a certain extent under a handicap owing to the reorganization and the amalgamation of stocks have coped very successfully with their work. The work of the depots is now in very good order and the personnel thoroughly adapted to the new conditions.

7. FINANCIAL STATEMENT

The total expenditure of the Naval Department under various appropriations for the fiscal year ended March 31, 1922, amounted to \$3,686,753.72.

The revenue of the department amounted to \$94,484.75.

Refunds on account of demobilization for previous years received by the department amounted to \$1,134,475.40.

The following is a detailed financial statement:—

Total revenue of the Department of the Naval Service for the fiscal year ended March 31, 1922..	\$ 94,484 75
Demobilization refunds, previous years..	1,134,475 40
	<hr/>
	\$1,228,960 15
	<hr/>
Net expenditure for the year on departmental appropriations.	\$3,686,753 72
Value of work done and materials supplied for accounts of other Canadian Government departments, British Admiralty and others..	1,139,717 16
	<hr/>
Gross disbursements for the year..	\$4,826,470 88

STATEMENT OF APPROPRIATION ACCOUNTS FOR FISCAL YEAR 1921-22

Service	Appropriation	Expenditure	Balance Unexpended
	\$ cts.	\$ cts.	\$ cts.
Naval Service.....	2,500,000 00	2,041,379 46	458,620 54
Fisheries Protection Service.....	370,000 00	325,830 20	44,169 80
Hydrographic Surveys.....	315,000 00	314,988 48	11 52
Radiotelegraph Service.....	456,480 00	441,014 76	15,465 24
Tidal Service.....	30,000 00	30,000 00	
Patrol of the Northern Waters of Canada.....	15,000 00	8,198 42	6,801 58
Customs Dues.....	500 00	186 77	313 23
Pay of Temporary officers and clerks.....	40,000 00	22,154 89	17,845 11
Demobilization.....	120,000 00	119,370 58	629 42
	<hr/>	<hr/>	<hr/>
	3,846,980 00	3,303,123 56	543,856 44
Civil Government.....	210,090 00	170,932 31	39,157 69
Contingencies.....	40,000 00	39,973 84	26 16

RECAPITULATION

Naval Service.....	\$3,846,980 00	\$3,303,123 56	\$ 543,856 44
Civil Government.....	210,090 00	170,932 31	39,157 69
Contingencies.....	40,000 00	39,973 84	26 16
	<hr/>	<hr/>	<hr/>
	4,097,070 00	3,514,029 71	5,830,040,29

Imperial Government (Special Account)—

Disbursements.....	\$208,606 01
Carried from 1920-21.....	366,368 22

Total.....\$ 574,974 23

Less

Reimbursements.....	\$478,985 44
Transferred to 1922-23.....	95,988 79

Total.....\$574,974 23

Provisional Bonus Allowance.....	\$ 81,613 52
Re-Classification Vote 529.....	85,110 49
Superannuation 44, Retirement Act, 1920.....	5,286 67
Miscellaneous Gratuities.....	713 33
	<hr/>
	\$3,686,753 72

SESSIONAL PAPER No. 17a

STATEMENT OF REVENUE FOR FISCAL YEAR ENDED MARCH 31, 1922

Royal Naval College—College fees..	\$	4,220 00
Casual revenue..		32,287 17
Wireless operators licenses		2,235 80
Wireless operators examination fees		292 00
Premium, discount and exchange..		140 14
Miscellaneous revenue		1 117 88
Radiotelegraph service		
Alert Bay..	\$	5,886 90
Bull Harbour		1,491 64
Cape Lazo..		577 23
Deadtree Point..		1,290 90
Digby Island..		5,807 38
Estevan Point..		4,524 64
Gonzales Hill..		6,507 55
Pachena Point..		67 05
Point Grey..		7,692 33
Triangle Island..		3,204 13
F.P.S. Givenchy..		3 54
" Malaspina..		10 44
" Thiepvat..		2 20
" Stadacona..		12 88
C.G.S. Acadia..		3 36
H.M.C.S. Aurora..		1 52
Barrington Passage		15,900 30
St. John D.F. Station..		526 62
Magdalen Islands (Grindstone)..		486 60
Kingston..		2 43
Midland..		21 66
Port Burwell..		6 19
Point Edward..		12 14
Port Arthur..		24 64
Sault Ste. Marie.....		77 66
Tobermory..		4 85
Toronto		14 98
		54,161 76
	\$	94,484 75
Demobilization (previous years)		1,134,475 40
		\$1,228,960 15

SUSPENSE ACCOUNTS

SHOWING VALUE OF WORK DONE AND MATERIAL SUPPLIED FOR ACCOUNT OF OTHER CANADIAN GOVERNMENT DEPARTMENTS, BRITISH ADMIRALTY AND OTHERS

	Dr.	Cr.	Balance	
			Transferred to 1922-23	Not transferred
	\$ cts.	\$ cts.	\$ cts.	\$ cts.
Air Board	11,568 78	11,254 30		314 48
British Admiralty	545,986 67	470,816 38	75,179 35	Cr. 9 06
British Ministry of Shipping.....	21,695 90	1,057 50	20,638 40	
Canadian Government Merchant Marine.	2,706 84	1,655 73		1 051 11
Department of Customs.....	4,951 74	4,905 54	46 20	
" of the Interior.....	20,430 76	20,280 25		150 51
" of Militia and Defence.....	6,641 86	6,634 96		6 90
" of Marine and Fisheries.....	55,311 06	52,423 00		2,888 06
" of Public Works.....	1,238 26	1,053 00		205 26
Royal Canadian Mounted Police	3,757 63	3,507 28		250 35
Miscellaneous.....	465,427 66	441,805 86	143 21	23,472 02
	1,139,717 16	1,015,373 80	96,013 16	28,330 20

STATEMENT OF EXPENDITURE UNDER THE NAVAL APPROPRIATION FOR THE FISCAL YEAR ENDED MARCH 31, 1922

Ship or Establishment	Pay and Allowances	Stores and Allowances	Medical Services	Boys Training and Recruiting	Repairs and Maintenance	Miscellaneous Effective Services	Non-Effective Pay	Advances Suspense Accounts, etc.	Total	Grand Total
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
H.M.C.S. <i>Anson</i>	347,534 62	115,205 27	3,576 63	492 34	70,131 84	17,569 31	19,888 35	574,398 36		
" " fuel		245,828 85						245,828 85		\$29,227 21
" <i>Patriot</i>	90,315 22	42,582 95	1,336 49	98 12	41,810 96	2,035 81	6,017 43	184,196 98		
" " fuel		83,296 74						83,296 74		267,493 72
" <i>Patrician</i>	83,533 01	44,489 34	507 09		48,936 53	2,366 74	5,956 10	185,788 81		
" " fuel		68,834 67						68,834 67		
Submarines <i>C.H. 14</i> and <i>C.H. 15</i> and Depot	59,841 36	63,789 62	1,002 46	672 14	14,421 16	2,823 29	975 67			254,623 48
Royal Naval College	102,236 24	31,499 51	2,972 10	262 48	3,249 08	26,012 74	3,855 10			143,535 70
Youths' Training Estab)	34,550 05	53,544 88	955 88	3,193 47	22,598 66	3,136 32	2,285 60			169,387 25
Headquarters	31,662 90	7,775 71	56 00			11,286 73	2,371 41			120,264 86
Canadian Officers Overseas	195,410 15	11,469 90	2 00	195 00	604 54	3,430 71				53,152 76
Barracks—Halifax	12,116 96	9,692 04	354 60	1 00	36 00	1,574 21	428 27			210,012 76
" —Esquimaux	6,842 58	94 26				2,223 16				24,965 62
General Account		39,195 19		1,525 41		3,548 75	3,835 50			9,197 00
Halifax					647 28					48,104 85
Stores		(Credit								647 28
		346,398 45)								(Credit
Supply Base Dr. Opr. expenses ..	1,552 58	60,573 09			21,339 58	8,916 40				346,398 45
" (r. Percentages ..		(Credit								92,382 46
		37,614 15)								(Credit
Repair Base Dr. operating expenses ..	2,070 10				57,035 27	8,224 01				37,614 15)
" (r. Percentages ..					(Credit					67,329 38
					48,634 17)					(Credit
Fleet General	1,552 58				20,368 90	4,179 18				48,634 17)
Armament and Torpedo Depot ..	3,672 98	40,579 14			4,388 36	627 29	384 50			26,070 66
Esquimaux	4,405 10	19,783 85	20 28		12,587 50	8,668 49				49,952 27
(r. Percentages		(Credit			(Credit					45,465 22
		18,499 99)			1,685 93)					(Credit
Armament Supply Depot ..	4,188 13	32,228 15			1,546 15	1,026 68				20,185 92)
Allotments	24,079 36									38,990 11
Sundries								28,330 20		24,079 36
										28,330 20
	1,005,563 92	568,251 38	10,083 52	6,439 96	269,351 71	107,359 82	45,997 94	28,330 20		2,041,379 46

8. CANADIAN ARCTIC EXPEDITION

The Canadian Arctic Expedition, under the leadership of Mr. V. Stefansson, set out for the Arctic in the summer of 1913.

The Departments of the Naval Service, Geological Survey, Marine and Fisheries, Interior and Customs, all being interested in the results obtained by this expedition, co-operated towards its fitting out and providing the personnel, whilst its general direction was entrusted to the Department of the Naval Service.

The expedition was divided into two main parties, the Northern and Southern Divisions. The Northern Division carried out investigations over Beaufort sea and the far northern islands. Exploration work in this area lasted from March, 1914, until September, 1918.

Three large new islands were discovered to the northeast of Prince Patrick island and geographical investigations of Banks island, Prince Patrick island and Melville island were made. A careful study of the animal and vegetable life of the northern islands was made and where possible examination of mineral deposits was carried out. Coal was discovered on Banks island which could be easily mined in small quantities, owing to its proximity to the surface.

The C.G.S. *Karluk*, which was put into commission for exploratory purposes in connection with the Northern Division of the expedition, was sunk in ice floes early in 1914. As a result of this loss, a large part of the exploratory work was done on foot. Mr. Stefansson and members of the Northern Division established a new system of exploration whereby they lived on the resources of the country. On ice trips polar bears and seals supplied food for both the men and dogs, as well as clothing and oil fuel. While exploring the northern islands, the meat supply was obtained from the large herds of caribou which frequent the islands during the summer months.

The work of the Northern Division was well performed, considering the difficult regions covered, the climatic conditions and the obstacles encountered in transportation. New lands were added to the British Empire and many of the unknown areas of lands already located were surveyed and their positions definitely fixed.

ICE EXPLORATION

In 1917, plans were laid for a trip across Beaufort sea on the ice to ascertain if islands hitherto undiscovered exist and also to investigate the action of the currents in Beaufort sea. Owing to illness Mr. Stefansson was unable to take charge of this party, but Mr. Storker T. Storkerson undertook the work.

The party left the mainland and encamped on floating ice early in 1918. They floated with the ice for a period of nine months and covered a considerable area of Beaufort sea hitherto unexplored. Careful soundings were taken to ascertain the exact location of the edge of the continental shelf. Investigations of the action of the current were also made.

The party returned to land in the fall of 1918.

SOUTHERN DIVISION

The Southern Division of the expedition carried out the work allotted to it in a creditable manner.

The geographical characteristics of the north coast of Canada were carefully investigated and the shore line was mapped. Much valuable geographical information was obtained, as well as detailed information concerning the life and history of the Eskimo.

The Southern Division was in much closer touch with civilization than the Northern Division, as they were within easy reach of the outpost stations of the Royal Canadian Mounted Police and the Hudson's Bay Company.

The Southern Division completed its work in the summer of 1916.

SESSIONAL PAPER No. 17a

VOLUME IV—BOTANY

- Part A—Freshwater Algae and Freshwater Diatoms. By Charles W. Lowe. (In preparation.)
 Part B—Marine Algae. By F. S. Collins. (In preparation.)
 Part C—Fungi. By John Dearness. (In preparation.)
 Part D—Lichens. By G. K. Merrill. (In preparation.)
 Part E—Mosses. By R. S. Williams. (Issued February 8, 1921.)

VOLUME V—BOTANY

- Part A—Vascular Plants. By James M. Macoun and Theo. Holm. (Issued October 14, 1921.)
 Part B—Contributions to the Morphology, Synonymy and General Distribution of Arctic Plants. By Theo. Holm. (In press.)
 Part C—General Notes on Arctic Vegetation. By Fritz Johansen. (In preparation.)

VOLUME VI—FISHES, TUNICATES, ETC.

- Part A—Fishes. By F. Johansen. (In preparation.)
 Part B—Ascidians, Etc. By A. G. Huntsman. (In preparation.)

VOLUME VII—CRUSTACEA

- Part A—Decapo Crustaceans. By Mary Rathburn. (Issued August 18, 1910.)
 Part B—Schizopod Crustaceans. By Waldo L. Schmitt. (Issued September 22, 1919.)
 Part C—Cumacea. By W. T. Calman. (Issued October 15, 1920.)
 Part D—Isopoda. By P. L. Boone. (Issued November 10, 1920.)
 Part E—Amphipoda. By Clarence R. Shoemaker. (Issued September 7, 1920.)
 Part F—Pycnogonida. By Leon J. Cole. (Issued January 3, 1921.)
 Part G—Euphyllipoda. By F. Johansen. (In preparation.)
 Part H—Cladocera. By Chancey Judy. (Issued June 23, 1920.)
 Part I—Ostracoda. By R. W. Sharp. (In preparation.)
 Part J—Freshwater Sopedoda. By C. Dwight Marsh. (Issued April 21, 1920.)
 Part K—Marine Sopedoda. By A. Willey. (Issued June 25, 1920.)
 Part L—Parasitic Sopedoda. By Charles W. Wilson. (Issued June 25, 1920.)
 Part M—Cirripedia. By H. A. Pilsbury. (In preparation.)

VOLUME VIII—MOLLUSKS, ECHINODERMS, COELENTERATES, ETC.

- Part A—Mollusks, Recent and Pleistocene. By William H. Dall. (Issued September 24, 1919.)
 Part B—Cephalopoda and Pteropoda.
 Cephalopoda. By S. S. Bary.
 Pteropoda. By W. F. Clapp. (In preparation.)
 Part C—Echinoderms. By Austin H. Clark. (Issued April 6, 1920.)
 Part D—Bryozoa. By R. C. Osburn. (In preparation.)
 Part E—Rotatoria. By H. K. Harring. (Issued December 31, 1921.)
 Part F—Chaetognatha. By A. G. Huntsman. (In preparation.)
 Part G—Acyonaria and Actinaria. By A. E. Verrill. (Issued April 28, 1922.)
 Part H—Hydroids. By C. McLean Fraser. (In preparation.)
 Part I—Porifera.
 Part J—Medusae and Ctenophora. By H. B. Bigelow. (Issued June 30, 1920.)

VOLUME IX—ANNELIDS, PARASITIC WORMS, PROTOZOANS, ETC.

- Part A—Oligochaeta.
 Lumbriculidae. By Frank Smith.
 Enchytraeidae. By Paul S. Welch. (Issued November 20, 1920.)
 Part B—Polychaeta. Ralph V. Chamberlin. (Issued November 20, 1920.)
 Part C—Hirudinea. By J. P. Moore. (Issued February 4, 1921.)
 Part D—Gephyrea. By Ralph V. Chamberlin. (Issued June 20, 1920.)
 Part E—Acanthocephala. By H. J. Van Cleave. (Issued April 7, 1920.)
 Part F—Nematoda. By N. A. Cobb. (In preparation.)
 Part G-H—Trematoda and Cestoda. By A. R. Cooper. (Issued February 4, 1921.)
 Part I—Turbellaria. By A. Hassell. (In preparation.)
 Part J—Gordiacea.
 Part K—Nemertini. By Ralph V. Chamberlin. (In preparation.)
 Part L—Sporozoa. By J. V. Mavor. (In preparation.)
 Part M—Foraminifera. By J. A. Cushman. (Issued February 6, 1920.)

VOLUME X—PLANKTON, HYDROGRAPHY, TIDES, ETC.

- Part A—Plankton. By Albert Mann. (In preparation.)
 Part B—Marine Diatoms. By L. W. Bailey. (In preparation.)
 Part C—Tidal Observations and Results by W. Bell Dawson. (Issued October 1, 1920.)
 Part D—Hydrography. (In preparation.)

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VOLUME XI—GEOLOGY AND GEOGRAPHY

- Part A—The Geology of the Arctic Coast of Canada, West of Kent Peninsula. By J. J. O'Neill. (In preparation.)
- Part B—Maps and Geographical Notes. By Kenneth G. Shipman and John R. Cox. (In preparation.)

VOLUME XII—LIFE OF THE COPPER ESKIMOS (Complete)

- The Life of the Copper Eskimos. By D. Jenness. (Issued.)

VOLUME XIII—PHYSICAL CHARACTERISTICS AND TECHNOLOGY OF THE WESTERN AND CENTRAL ESKIMOS

- Part A—The Physical Characteristics of the Western and Central Eskimos. By D. Jenness. (In preparation.)
- Part B—The Osteology of the Western and Central Eskimos. By John Cameron. (In preparation.)
- Part C—Technology of the Copper Eskimos. (To be prepared.)

VOLUME XIV—ESKIMO FOLK-LORE AND LANGUAGE

- Part A—Folk-lore, with Texts, from Alaska, the Mackenzie Delta, and Coronation Gulf. By D. Jenness. (In preparation.)
- Part B—Comparative Grammar and Vocabulary of the Eskimo Dialects of Point Barrow, the Mackenzie Delta, and Coronation Gulf. By D. Jenness. (In preparation.)

VOLUME XV—ESKIMO STRING FIGURES AND SONGS

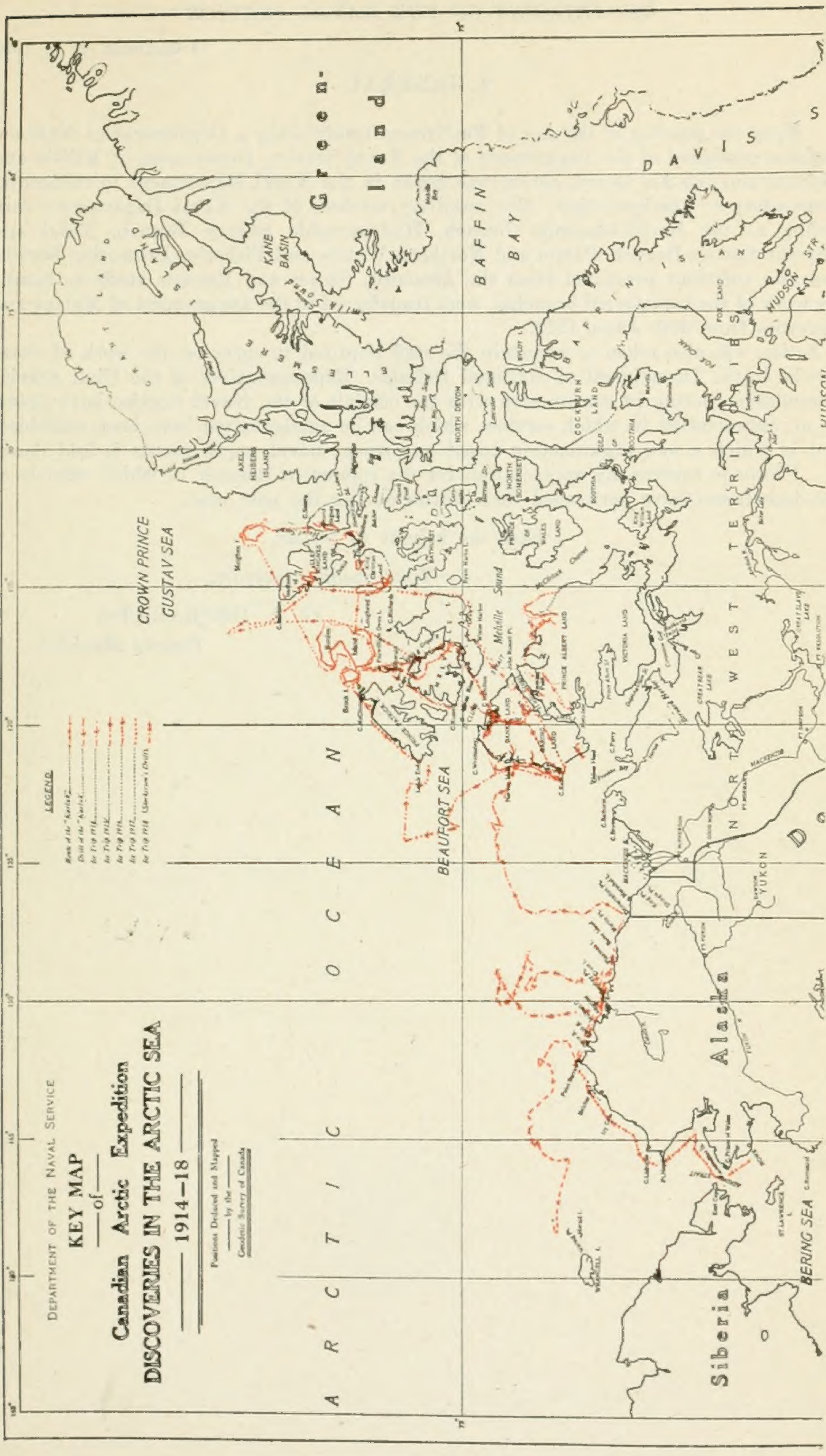
- Part A—String Figures of the Eskimos. By D. Jenness. (Ready for Press.)
- Part B—Songs of the Copper Eskimos. By Helen H. Roberts and D. Jenness. (In preparation.)

VOLUME XVI—ARCHAEOLOGY

Contributions to the Archaeology of Western Arctic America. (To be prepared.)

The attached Key Map shows the various routes taken and areas covered by the Northern Division of the Canadian Arctic Expedition. The new islands discovered i.e., Meighen Island, Brock Island, and Borden Island are also shown.

The Patrol of Northern Waters including all outstanding matters in connection with the Canadian Arctic Expedition was transferred to the Department of Marine and Fisheries on the 1st July, 1922.



DEPARTMENT OF THE NAVAL SERVICE

KEY MAP

— of —

Canadian Arctic Expedition

DISCOVERIES IN THE ARCTIC SEA

1914-18

Positions Declared and Mapped

by the

Geodetic Survey of Canada

LEGEND

- Route of the "Aurora"
- Drift of the "Aurora"
- See Trip 1914
- See Trip 1915
- See Trip 1916
- See Trip 1917
- See Trip 1918 (See below's Drift)

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9. GENERAL

Upon the passing of the Act of Parliament establishing a Department of National Defence composed of the Department of the Naval Service, Department of Militia and Defence and the Air Board, action was begun in the Naval Department to reorganize preparatory to amalgamation. The auxiliary services of the Naval Department, consisting of the Radio-telegraph Branch, Hydrographic Survey Branch, Tidal and Current Survey Branch, Patrol and Northern Waters and Fisheries Protection Service and also sufficient personnel from the Accounts, Stores and Records staffs to handle the work of the transferred branches, were transferred to the Department of Marine and Fisheries from 30th June, 1922.

Action was also taken to ascertain the staff required to carry on the work of naval service in the Department of National Defence. Representatives of the Civil Service Commission, acting in conjunction with the officials of the Naval Service have drawn up an organization in which services which can be amalgamated have been combined, and in which a new organization based on present naval requirements is laid down.

I have to express my appreciation for the competent manner in which officials of the department have performed their duties during the past year.

I have the honour to be, sir,

Your obedient servant,

G. J. DESBARATS,

Deputy Minister.

